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ABSTRACT

This study examines alternatives to direct transmission of television and radio programs for courses with low student enrollment at the Open University. Examined are cut-off points in terms of student numbers at which alternative means of distributing audio or audio-visual materials become more economical than direct television or radio transmission, organizational and design implications of using alternative distribution systems, and recommendations regarding alternative methods. This final phase of the study explores comparative costings, the organizational and production implications of alternative media, and some possible implications for a new studio center and a renewed BBC/OU agreement. The central concern is to study those ways of providing audiovisual media in student homes that are likely to be feasible in the near future. An examination of university courses, student enrollment, broadcast times, and home based audiovisual equipment is presented. Costs are calculated for use per hour, per single tranmission, per repeat transmission, six year total, average per student (six years), likely number of users (six years), and a per user per repeat transmission category. Formats considered in this study include radio, records, flexi-discs, audio-cassette, television, video-cassette, multi-media, telephone teaching, teletext, electronic blackboards, digital audiovisual, and personal computers. (RAO)

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ALTERNATIVE MEDIA TECHNOLOGIES FOR THE OPEN UNIVERSITY

A research report on costed alternatives to the direct transmission of audio-visual materials

FINAL REPORT

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ALTERNATIVE MEDIA TECHNOLOGIES FOR THE OPEN UNIVERSITY

CONCLUSIONS AND POINTS FOR DISCUSSION

We hope that Open University staff will use the full report on Alternative Media Technologies as a source of information and stimulation regarding the various media potentially available to the University's teaching system. We have set out in Appendix 2 a list of people or organisations that can provide further information on the various pieces of technology described in this report. In addition Frances Berrigan and Anne Gibson have designed an audio-vision package on various ways in which audio-vision has been used in the University. (This can be borrowed from the Audio-Visual Media Research Group in IET).

Because of the report's length and technical nature, we have picked out some of the main points and topics which we believe should be more widely discussed within the University, and which might also provide an indication of what is in the report, and where to find it. These are summarised below:

Choice of Audio Medium.

1. Radio is the cheapest audio medium for courses with more than 500 students per year (pp.26-29).
2. For courses with substantially less than 1000 students a year, the difference in costs between audio cassettes, records and radio transmission are so small as to be safely ignored when considering the choice of an audio medium.
3. Flexi-discs only become cheaper than cassettes when courses have more than 1000 students a year (pp. 26-29).
4. The number of radio programmes for transmission should be gradually reduced, so that nearly all radio programmes can be repeated. Radio should be concentrated on courses with larger student numbers. For courses with low student numbers, radio should be used more sparingly, in conjunction with cassettes or records. On some courses, it should nor be used at all (p. 32).
5. There is considerable scope for an increase in the use of non-broadcast audio media (p.32).
6. The educational criteria on which selection of audio media should be based, (pp.29-31) together with recommendations 1-5, should be made available to all course teams.

Costings

7. Distribution costs are a more useful indicator of comparative costs than production costs because they are directly related to the amount of material to be distributed, and except for radio, television, and flexi-discs, distribution costs are also directly related to the number of students who will receive the materials (pp.61-63)
8. When there is a large number of small courses, it is dangerous to minimise the costs of audio-visual media on the grounds that it will be used by only small numbers of students. These costs in fact when aggregated <u>across</u> all the courses will add to a substantial amount of expenditure. In any case, <u>production</u> costs will be incurred, irrespective of the number of students, and will also aggregate across the courses (p.61).

Audio-Vision

9. Audio-vision, the linking of still visual material with audio material is a potentially very powerful teaching medium. In the form of radio-vision, it could strengthen the role of radio on courses with large student numbers. With the audio material distributed on audio-cassette or disc it could ease the transmission problem for radio by being a replacement, partial or total, on courses with low student numbers (p.46).

10. An increase in the production of non-broadcast audio media will involve additional distribution costs, but should not involve the University in additional production costs unless it is decided that the combined radio/non-broadcast audio production level requiring a BBC input substantially exceeds the BBC's current production capacity. If that should happen, we suggest that production requirements be met by Audio-Visual Services at Walton Hall, until the new Studio Centre opens (p.70).

11. The additional distribution costs for audio-vision (over and above existing distribution costs for television and radio) will not greatly exceed £250,000 per annum in the steady state, even if there was an extensive use of audio-vision across all courses (p.46).

Electronic Technology

12. Because there is no immediately available alternative to television, we recommend that the provision of a video-replay service for study centres must be the first priority for funding, to ensure that existing media, in which there has already been a massive investment, can be fully used by students.

13. Other potentially useful equipment is being developed but will not likely be sufficiently researched or economic before 1980. The University needs to monitor more carefully and thoroughly than previously developments in electronic media, as they may have vital implications for course design.

14. At this moment in time it is difficult to recommend any one electronic Audio-Visual technology as being of particular potential to the Open University.

15. We think that one priority for research is electronic media to be carried out at the University should be in the development of digital cassette vision, using or adapting existing low-cost processing hardware - such as TV games technology - rather than developing original processing hardware. Other efforts might concentrate on simplifying the method of preparing graphics, and on exploring the most appropriate educational uses, for digital cassette vision (pp.56-58).

16. The most promising long-term development at this moment in time appears to be Viewdata. The University should publicly support and try to influence this development (pp.52-55).

17. Programming and systems being designed at the University for use in the student's home, and using the domestic television set as a visual display unit, should try to ensure that the programming, visual display, and data control and accessing are as far as possible compatible with and exploit fully the Viewdata system (pp62-63).

18. A joint research project with the Post Office should be mounted to use Viewdata facilities as an integral part of the design of a course being presented for the first time in 1980 or 1981 (pp. 52-55) *

19. Students should be informed of the potential of Viewdata, but no recommendation to buy Viewdata-adapted sets should be made by the University until the Post Office offers a full service in 1980 (p.54).

20. Planning Board might like to consider whether guidance should be given to Open University staff engaged in research into the design of equipment with a potential for Open University teaching, regarding the likely maximum unit cost that Planning Board would be prepared to consider for a single item of equipment to be distributed to students. A unit cost of £100 would appear to be a resonable upper-limit (p. 63).

Organisation and Policy

21 We recommend that Research Committee funds should not be debarred from those wishing to research and develop equipment which might be relevant to Open University teaching (pp. 65-66). If this recommendation is not acceptable to the Research Committee, the problem of funding developments in new media should be examined by the Media Development Group, (see point 26), which would make a recommendation to Planning Board on this issue (pp.67-69).

22. If the University wishes to design and develop distance teaching equipment, it ought to consider whether the University should build up a research "business", with marketing expertise, and capital investment, either on its own, or in partnership with a commercial company. It should also consider whether the Research Committee or Planning Board should advise academics that the University will not generally fund new inventions beyond the prototype stage (p. 66).

23. Broadcast Sub-Committee and Course Resources Committee need to discuss how course teams with low student numbers can be encouraged to reduce their bids for broadcasting and to increase their bids for non-broadcast audio-vision resources (p.67).

24. An informal BBC/OU working group should be set up to discuss the production implications of non-broadcast media materials (pp.70-1). *

25. Space in the new Studio Centre should be available for a small amount of non-broadcast video generating equipment, to be used in conjunction with sound production, for non-broadcast cassette vision.

26. The University should set up a Media Development Group, responsible for promoting media developments, sifting, giving priority to and endorsing proposals for media research and development funds, monitoring expenditure on different audio-visual media, and encouraging course teams to pilot new media developments (pp. 67-68) *

27. The joint BBC/OU Management Committee should urgently discuss the location of the production of non-broadcast media materials (pp. 70-71). *

*Points already under discussion within the University.

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The production of this report would have been impossible without the assistance of many persons. We would like to thank, in particular, Maggie Lawson of the Academic Secretariat and Stacy Pandit of Academic Planning for providing up to date information on course planning and student numbers. We would also like to thank Barry Hollis of the Bursary, Peter Girling (Director of Operations), Lesley Lonsdale-Cooper (Director of Publishing) and Alan Gayler and David Dunford of Purchasing for providing details on the cost and handling of various audio-visual items. From the BBC we would like to thank, in particular, Jim Stevenson for clarifying many of the costs associated with broadcast production and distribution.

The Exhibition of Alternatives which was held at Walton Hall on April 27th was an important part of this study. More than 22 individual exhibits of different audio-visual technologies and programme production types were on display. The number of individuals who offered their time, without charge, to mount these exhibits are too numerous to mention here. A complete list of the exhibitors and the non-broadcast technology to which they are associated is provided in Appendix 2 for readers who wish to obtain more details of particular developments. The fact that more than 400 people visited the Exhibition is witness to the amount of effort which the exhibitors put into their displays. We would especially like to thank Anne Gibson of IET for her assistance in preparing programme guides and display headings for the Exhibition and for preparing a display of non-broadcast audio-visual materials presently used by Open University courses.

Finally we would like to thank all the members of the Steering Group for the Study of Costed Alternatives to Open Circuit Transmission for their invaluable assistance. The Steering Group met four times to discuss each stage of the study and the final report itself. Clearly this was a considerable burden on the members' time. We would like to give special thanks to the Chairman of the Steering Group, Professor Russell Stannard, who somehow managed to find time from his numerous duties as Pro-Vice Chancellor Planning.

With so much help and advice behind us, it will be apparent that any short comings in the report, any carelessness, errors, wrong or misconceived interpretations and omissions must be entirely the fault of the authors.

THE ORIGIN OF THE STUDY

The Institutional Research and Development Committee in June 1976 awarded the Audio-Visual Media Research Group a sum of £5,174 to examine alternatives to direct transmission of television and radio programmes for courses with low student numbers. The aims of the study were:

> To study the cut-off points in terms of student-numbers at which alternative means of distributing audio or audio-visual materials become more economical than direct television or radio transmission, to look at the organisational and design implications of using alternative distribution systems, and to put forward a set of recommendations regarding alternative methods to the Broadcast Sub-Committee.

The study arose as a result of a Broadcast Sub-Committee minute (24.20) of 28th May, 1975:

> "that there is an urgent need for a study of costed alternatives to open-circuit transmission for presenting programmes to students."

General Purpose Committee set up a Steering Group to monitor the study (see Appendix 1 for membership of the Steering Group).

The study was thought to be necessary because a survey carried out in 1974[1] indicated that the loss of repeat broadcasts was likely to reduce the number of students able to watch or listen to any particular programme by between 20%-35%, as there is always likely to be this proportion of students who cannot be at home at the time of the single transmission. It was also realised that there were in any case interesting developments in non-broadcast media which might be relevant in the near future for Open University courses, and that steps should be taken to ensure that the University kept abreast of such developments.

The first phase of the study was an analysis of the likely developments in course and broadcast production and transmission, and in course sizes, between now and the "steady state" situation in 1982. A report on Phase 1 was circulated to and discussed by the Steering Group in February, 1977.

The second phase consisted of a survey of non-broadcast media currently available, or likely to be available within the next five years, which at first sight might be considered appropriate for Open University courses. This culminated in an exhibition of such media at Walton Hall in April, including a programme giving details of each piece of equipment or media system.

The third and final phase of the study examines comparative costings, the organisational and production implications of alternative media, and some possible implications for the new studio centre and a renewed BBC/OU agreement. This report on the third phase builds on and includes the work of the first two phases.

1. BATES, A.W. Student Use of Open University Broadcasting, Milton Keynes, Open University, 1975.

What do we mean by Alternatives to Direct Transmission?

No two media are educationally equivalent. Every medium has its own unique set of educational characteristics. This is not to say that, given enough time, resources and imagination, students could not learn from any single medium, or any combination of media. Nevertheless, media are different, both technologically and educationally. For instance, radio has unique educational characteristics which are lost immediately the content is transferred to cassette or records. Radio is transient, immediate, and continuous. Cassettes are - or can be - permanent, time-free, and interruptable. These differences in media affect not only the way students use them, but the way teachers prepare and design their "lessons". Changing from one medium to another therefore - even if content is held constant - brings some educational advantages, and other educational disadvantages.

In one sense, then, there are no alternatives to direct transmission of television and radio, if by alternative, one means the substitution of methods of production or distribution in strictly comparable, educational terms. Each medium will bring educational losses and gains, and changes in the design of educational materials. What is under discussion then is the likely educational losses and gains to be had from alternative media, balanced against their cost advantages and the implications of such media for course design. Since there is no way in which educational advantages and disadvantages can be meaningfully reduced to cost equivalents, it becomes a matter of subjective judgement as to whether the change in educational characteristics is worth the extra costs or savings incurred by the introduction of a new medium of teaching. Thus although for purposes of analysis, we have separated costs, educational features, and design implications, they are inextricably intertwined, and must in the final analysis be considered together. An analysis of costs in isolation is meaningless. On the other hand, media can involve high levels of expenditure. Given that the University, or, if not the University, the Government, has a limited amount of money available, the costs of using certain media have to be taken into consideration. Put crudely, if the University invests £300,000 in electronic blackboard, this will be at the expense of some other desirable development, either within the University, or within society at large. The University needs to know as accurately as possible therefore what is it likely to gain as a result of such an investment.

For these reasons, we have not limited our study to the transference of existing radio and television programmes to other "equivalent" means of distribution, since there are no strictly equivalent means, in educational terms. The study can only be meaningful if the differences in educational media are examined, since the search for educational "equivalence" is a chimera. Thus the report's central concern is to study those ways of providing audio-visual media in student homes that are likely to be feasible in the near future.

Furthermore, the study is not concerned with finding a replacement for the existing uses of television and radio. Our study of alternative technologies resulted from a need to seek solutions to new problems being faced by the Open University, and not from any dissatisfaction with broadcasting. The research carried out by the Audio-Visual Media Research Group, and the general view of the academic body, as reflected in responses by Faculties to questions from the Courses Committee following the "Bates report" in 1975, both clearly indicate the value of television in particular as part of the University's teaching system.

This present study also confirms that there is still no economically viable alternative to getting television programmes to students for use in their own homes other than by direct transmission. Therefore, we believe that television should - and will - remain the first choice for the provision of home-based audio-visual materials.

The case for radio is not quite so clear-cut. In most Faculties, the student use of radio has been consistently low, nor has student usage increased in the last two years from the low level recorded in 1974. Nevertheless, for a substantial number of courses, and for some students on all courses, it remains a valuable medium, and is, at least for courses with more than 500 students, still the cheapest method of delivering audio material.

We therefore see a continuing role for television and radio as important components of the Open University system. Nevertheless, the University is moving into a new stage of development as it approaches its steady state, and our study aims to examine the possible role of other audio-visual media, alongside television and radio, in tackling the problems that the University will be facing over the next five to ten years.

THE NEED FOR ALTERNATIVES TO DIRECT TRANSMISSION

What are these difficulties that the University will be facing? They stem primarily from the need to provide adequate audio-visual support for 87 full credit equivalents, plus a growing post-experience programme, within a limited amount of broadcast transmission time. At the same time, the student population is not growing in proportion to the growth in courses, and this is leading to a rapid increase in courses with low student numbers.

Transmission Time

1. The Present Situation

Currently, the University is using 35 hours 25 minutes per week of television transmission time (already more than five hours over the original agreement). To accommodate this level, broadcasts begin at 6.40 in the morning on both BBC 1 and BBC 2, and 4.55 in the afternoon on BBC 2, during the week. There are also broadcasts all through Saturday and Sunday mornings on BBC 2.

For radio, the OU is using 26 hours 05 minutes per week of transmission time. Broadcasts begin at 6.00 in the morning on VHF Radio 3, and begin at 5.45 in the evening, during the week. For students in the North of Scotland and Wales, there are broadcasts between midnight and 1.00a.m. during the week. There are also broadcasts on Saturday and Sunday mornings, and Saturday afternoon (except in the North of Scotland and Wales) on VHF Radio 3 or 4.

The reason why the OU is not using the full 30 hours a week radio transmission time negotiated in the original BBC/OU agreement is that the additional times offered to the OU by the BBC (before 6.00a.m., mid-afternoon on week days, or after midnight) are considered by the University to be inappropriate for OU students.

Informal discussions with the BBC suggest that it is unlikely that they could provide any significant increase in this amount of transmission time, or provide transmission slots at more convenient times than at present, on existing channels, at least over the next few years.

2. Annan and the Implications for the Open University

Despite the recent publication of the Annan Report on the Future of Broadcasting[1], the likelihood of the University having access to additional transmission time on other channels is still uncertain.

Annan and his committee propose the creation of a fourth national television channel and a fourth (new) national VHF radio channel, to be run by a newly established Open Broadcasting Authority. His committee also proposes a local radio system, and possibly a local television system, to be run by another newly established Authority, the Local Broadcasting Authority. Annan recommends that the bulk of Open University television programmes should go on the fourth (national) television channel, and similarly the bulk of OU radio programmes would go on the proposed new national VHF radio channel.

1. HOME OFFICE. Report of the Committee on the Future of Broadcasting (Annan Report), London, HMSO, 1977.

Some educational broadcasting though would still be carried on BBC, IBA and local broadcasting channels, and the fourth TV and fourth VHF radio channels would not be used exclusively - or even mainly - for educational broadcasting, but would also include a wide variety of programming, from independent producers, from the commercial television companies, from minority groups, and in Wales for programmes in the Welsh language. Both the new national channels would be funded from a variety of sources including block advertising, various forms of sponsored programmes, and grants from educational sources (such as the DES, for OU programmes).

In principle, therefore, there appears to be the possibility of expanding the amount of transmission time for OU programmes. In practice, however, we believe that this is unlikely to happen, for a variety of reasons.

a. There is no possibility of a fourth television channel with national coverage before 1982. It will take until 1979 at the earliest to pass the necessary Parliamentary legislation, and a minimum of three years after that date to engineer a network with national coverage. (The OU would not want less than the 97% coverage already given by BBC 2.) The fourth VHF radio channel will use the 97.6-100 MHz band, currently used by mobile radio services, and this band will not be cleared before mid-1981, for use as a national network.

b. There is a very strong probability that there will be no fourth television channel at all of the kind proposed by Annan. The Conservative Party spokesman on broadcasting, Julian Critchley, has stated that a Conservative Government would give the fourth channel to the IBA and ITV companies, and it is not a foregone conclusion that a Labour Government (or a Labour/Liberal Government) will necessarily set up the fourth channel in the way proposed. Even if the present - or a future - government does agree in principle to the Annan proposals, the fourth television channel is not likely to be available until several years after 1982, since Annan recommends that: "the fourth channel should not be allocated until the nation's economy will permit the kind of service we have outlined."

c. Both the IBA and the commercial television companies in their evidence to Annan agreed that part of the fourth channel - even if ran by the IBA - should not be devoted entirely to the programmes of the commercial companies. The IBA spoke of the need to provide programmes for minority and educational interests and time for independent and outside producers. However, even if the fourth channel were to be allocated in the near future to the IBA, with access to this channel for Open University programmes, it would still be a number of years before the fourth channel would be suitable for the Open University. It would cost only £8 million to cover 80% of the population, but £17-20 million to cover the additional 20% that would give national coverage. It is quite likely that for economic reasons it would be many years before all areas were covered on a fourth TV channel.

d. Whoever runs the fourth channel, the Open University is likely to encounter considerable difficulty in getting all the time it requires on these channels. Advertising will be a major source of funding for either the OBA or the IBA, with the inevitable commercial pressures for large audiences, at least at peak viewing times. The University (with, as we shall see, potential audiences of less than 500 for many programmes for substantial amounts of transmission time) will not be in all that strong a position in challenging against other competitors, whether they be powerful commercial or independent television companies, or the growing number of broadcast-minded minority groups seeking air-time.

3. Planning Strategy for Transmission Times

Predicting the future, even the near future, is a hazardous task, but is likely that transmission facilities will remain as scarce as they are currently, for at least several years after the University reaches its steady state. It would seem sensible and realistic then for planning to proceed on the assumption that the University cannot expect any substantial improvement in transmission facilities for at least the next eight to ten years, either in quantity or in the convenience of times.

Courses

Predictions regarding the rate at which courses will be produced over the next five years vary virtually from day to day, dependent on the latest DES decision regarding funding, and even more so on the changes in course teams' confidence in meeting their target presentation dates. This makes it extremely difficult to predict the number of programmes which will need to be transmitted each year up to 1982, even given a constant broadcast allocation policy. However, the University is still committed to reaching a "steady state" of 87 full credit undergraduate courses (or the equivalent in part-credits) and approximately four post-experience FCE's (full credit equivalents), for presentation during the 32 week academic year, in 1982. The number of programmes likely to be transmitted in any one year will depend on the number of courses (as distinct from remakes) being presented in each Faculty area, since allocations of broadcasts vary from Faculty to Faculty. Table 1 (below) shows the current average allocations, up to and including courses being presented for the first time in 1980. (In our calculations, data are based on decisions as at March 30th 1977, and have not been adjusted to take account of subsequent course or broadcast allocation decisions.)

Table 1. Current average allocations of programmes per FCE to 1982 (during academic year)*

Faculty	TV		Radio		FCE's	
	Foundation	Post. found.	Foundation	Post. found.	1977	1982
Arts	32	17.1	32	24.0	15.2	16
Social Sciences	32	17.0	32	24.7	13.0	17
Educational Studies	-	15.7	-	24.0	7.2	10
Mathematics	32	23.2	32/16**	14.3	8.6	10
Science	32	31.7	32/16**	15.5	9.3	15
Technology	32	23.6	32/16**	16.7	8.7	15
'U' courses	-	20.7	-	20.7	-	4
PE courses	-	20.3	-	23.0	2	4
Open Forum	-	22.0	-	32.0	-	-

* Some Faculties, and PE, have additional programmes broadcast outside the academic year of 32 weeks.

** Currently, M100, S100 and T100 have 32. M101 and S101 will have 16, and possibly T101 also.

It can be seen that Science is the heaviest user of television, and Arts, Social Sciences and Educational Studies are the heaviest users of radio. Each Faculty has a "target" or limit of FCE's in the overall 87 FCE "profile". Faculties are arriving at that target at different rates. Arts is almost there, while Science will not complete its profile probably until 1982. This affects the rate at which programmes for "new" courses are added to the transmission load. Increasingly, Arts and Social Sciences, having almost reached their profile, will be engaged in remakes of existing courses, which will not put any extra load on transmissions, their "new" programmes merely replacing old ones. Science and Technology however, as well as remaking some courses, will be engaged in the production of additional courses, and since their allocation of television programmes is greater per FCE, there will be a substantial increase in the number of programmes to be added to the transmission load between now and 1982.

At its meetings in May of this year, the Broadcast Sub-Committee was allocating resources for courses with their first transmission up to 1980. If the current average rate of allocations were to be continued into 1981 and 1982, the number of programmes to be transmitted in 1982 would be as in Table 2.

Table 2. No. of programmes in each faculty area in 1982, on current allocation policy

		Television			Radio		
Faculty	(a) Post found. FCEs	(b) Ave.no. of progs. (post found.)	(c) No. of progs. (Found.)	Total (axb)+c	(d) Ave.no. of progs. (post found.)	(e) No. of progs. (Found.)	Total (axd)+e
Arts	15	17.1	32	288	24.0	32	392
Soc. Sciences	16	17.0	32	304	24.7	32	427
Ed. Studies	10	15.7	-	157	24.0	-	240
Mathematics	9	23.2	32	240	14.3	16	144
Science	14	31.7	32	475	15.5	16	233
Technology	14	23.6	32	362	16.7	16	249
U	4	20.7	-	82	20.7	-	82
PE	4	20.3	-	81	23.0	-	92
Open Forum	-	-	-	22	-	-	32
Total				2011			1891

It is more difficult to calculate the intermediary situation for 1980 and 1981, since course production targets may not be reached in those years, but we can make an intelligent guess. Assuming then that the University is limited to its current transmission capacity, additional programmes can be accommodated only by removing the repeat facility from existing courses. Table 3 sets out the likely situation between now and 1982, again assuming current allocation policies. Again, it is important to note that while there may be some variations between 1979 and 1981, the 1982 predictions would be accurate, if current policies continue.

Table 3. Transmissions 1977-1982 on current allocation policy

		1977	1978	1979	1980	1981	1982
No. of FCE's to be presented		62	69	75	80	86	91
Television.	No. of transmission slots per year*	2720	2720	2720	2720	2720	2720
	No. of programmes to be transmitted	1440	1553	1636	1745	1876	2011
	No. of single transmissions	160	386	532	870	1032	1302
	% of programmes receiving one transmission	11%	25%	34%	50%	53%	65%
Radio.	No. of transmission slots per year**	2496	2496	2496	2496	2496	2496
	No. of programmes to be transmitted	1427	1549	1654	1730	1822	1891
	No. of single transmissions	358	602	812	964	1148	1286
	% of programmes receiving one transmission	25%	39%	49%	56%	63%	68%

*85 slots per week x 32 weeks **78 slots per week x 32 weeks

The Need for Repeats

It can be seen that on current policies, only a third of television and radio programmes would be repeated in the steady state. Does this matter? We think it does, for several reasons:

1. Already, 20% of our students are on shift work, or have such an irregular pattern of working that they cannot be sure of being at home at the time of any regular, single transmission. This percentage is growing, as the proportion of "working-class" students increases. For many of these students, the regular single transmission time will always be impossible, meaning that they will unavoidably miss all the programmes. With a repeat facility in a different "block" of time (e.g. early morning, as opposed to evening or weekend or vice-versa), the maximum coverage can be increased from 80% to 97%.

2. In addition to the 20% who know they will always miss at least one in three of the programmes at a single transmission time, there is another 15%-20% who, while normally able to watch or listen at a particular time, will nevertheless miss a particular transmission because of "unusual" circumstances, such as being unusually delayed at work, visitors, a social engagement, etc., but who would nevertheless pick up a repeat. In essence, then, it is unlikely that a single transmission will reach more than about two-thirds of the students on a course, even if the single transmission is at a prime time, and even if the students find the programmes valuable.

3. If two-thirds of the courses have only single transmissions, and if single transmissions receive priority for "prime" times, courses with repeat programmes will have both transmissions at poor times, and even some of the courses with single transmissions will have to have poor times for one transmission.

4. Course teams are increasingly requiring students to view the television programmes, either by setting separate assessments on the broadcasts, or by integrating the programmes in such a way that the texts are difficult or even impossible to understand without students watching the broadcasts.

In essence, current allocation policy means that by 1982, a majority of students will be expected to watch and listen at grossly inconvenient times, (such as 6.00a.m.), and that a substantial number of students would have to give up or change their jobs, if they were to be able to watch and listen to the broadcasts. More likely many more students will find it impossible to enrol for the majority of courses in which they might be interested, or will be prevented from successfully completing their courses because of being unable to get the broadcasts.

It is of course possible that some students will be prepared to alter their life-styles in such a way that they can follow the broadcasts. We do not believe however that an Open University should put such demands on working adults. We therefore believe that it will be necessary for the University to change its current policies sooner or later, so that broadcasts will not be so inaccessible as the above figures suggest.

Production Levels at the BBC

The University has an agreement with the BBC which has led the BBC to provide a production capacity at Alexandra Palace of 300 television and 300 radio programmes, for Open University purposes. As well as physical resources, this also entails the employment of sufficient production, technical and administrative staff for such a level of production. There is some flexibility in these figures, it being possible to increase or decrease programme production by about 50 programmes either way. However, should programme production drop below a minimum average yearly rate of about 250 television and 250 radio programmes, there would be at least two serious consequences. The most serious is that there would either be redundancies or serious overmanning, with the concomitant effect of lowering morale. Secondly, much of the charge to the University for broadcasting - 77% - is accounted for by overheads, which remain roughly constant irrespective of the rate of production. The lower the level of production, the greater the increase in the average cost per programme. There is a strong economic case then for maintaining production at around 300 programmes per year.

However, we have already indicated that there is a transmission limitation of 2720 slots per year, for television, and 2496 for radio. If every programme were to be repeated, this would mean a total programme requirement of 1360 television programmes, and 1248 radio programmes. If courses are remade on average every six years, this would require, in a steady state, and with all programmes repeated, an annual production of 227 television and 208 radio programmes, plus programmes for "out of season", such as short PE courses. Current allocation policy will result in 2011 TV and 1891 radio programmes, or an annual production rate of 337 TV and 315 radio programmes. The new studio complex has a potential capacity for 400 television and radio programmes, with possibilities of further expansion beyond that point. It can be seen therefore that there is a serious mismatch between optimum production capacity, optimum transmission capacity, and current allocation policy.

Levels of broadcast production are influenced by three factors. The first is the average number of programmes allocated per course. The second is the number of courses. If the average allocation remains constant, and new courses are added to the total available, then programme production and the need for more transmission time increases. The third is the rate at which courses and/or programmes are remade. The shorter the average life of programmes, the greater the level of production required. However, this does not affect the demand on transmission time.

We would argue very strongly then that the University should avoid any policy which leads to increased pressure on existing transmission time. This means in general then a limit on production, except where this is due to an increased rate of production to allow for a faster rate of remaking courses or programmes.

Student Numbers

The matter is further aggravated by trends in course size. Already in 1977, over a third of the University's courses had less than 300 students, and more than half had less than 500 students. Courses with less than 300 students take up a quarter of all programmes allocated so far. According to figures provided by Academic Planning, this trend towards a greater proportion of courses with very low numbers will increase, rather than decrease.

Table 4 below indicates the likely situation in a steady state (source: Academic Planning).

Table 4. Estimated Number of Students on Courses in the Steady State

No. of students	≤ 100	≤ 200	≤ 300	≤ 400	≤ 500	≤ 1000	≥ 1000
No. of courses	2	18	22	21	21	47	6
% of courses (cumulative)	1	15	31	46	61	96	100

This will also lead to a decline in or total disappearance of face-to-face tutorial provision for many courses. By 1982, therefore, the University will be in a position where most of its programmes will be transmitted once only, at inconvenient times, to less than 500 students, without face-to-face tutorial provision, unless there is a change in current policy.

A Policy for Broadcasting in a Steady State Situation

Unless course production drops considerably behind schedule over the next three years, the situation outlined above is almost certain to happen in 1982. The University has already allocated resources for courses with first presentation in 1980, and since the bulk of "new" courses for presentation in 1981 and 1982 will be in the Science and Technology areas, traditionally the heaviest users of television, it will be very difficult to reduce allocations much below their present levels before 1982.

However, the Broadcast Sub-Committee is proposing that in the long term, it should gradually reduce the average level of television broadcast allocations per FCE by 20-25%, in order to allow most broadcasts to retain a repeat transmission. It is proposed to do this in two ways. Faculties will be asked to mount the equivalent of about 10%-15% of the 87 FCE's as low resource courses, without television. The remaining 10%-15% would be saved by reducing current allocation levels when courses come up for remake.

What might the steady state situation look like under such a policy? We can only guess at how allocations will actually be made in the future, and there will no doubt be much arguing and discussion about allocations between Faculties, but the picture might look something like Table 5.

Table 5. Possible Steady State Situation in Mid-1980's: Television

	Post found. FCE's	Post found. FCE's with broadcasts	Ave.no. of progs. (post found.) new*	current	No. of progs. (found.)	Total no. of progs. new	current
Arts	15	13	16	(17)	32	240	(288)
Soc. Sciences	16	14	16	(17)	32	256	(304)
Ed. Studies	10	9	16	(16)	-	144	(157)
Mathematics	9	8	16	(23)	32	160	(240)
Science	14	12	32	(32)	32	416	(475)
Technology	14	12	24	(24)	32	320	(362)
U	4	4	16	(21)	-	64	(82)
PE	4	4	16	(20)	-	64	(81)
Open Forum	-	-	-	-	-	16	(22)
	86(+ 5found.)	76 (88%)	17.5	(22)		1680	(2011)
Annual production with remakes every six years						280	(335)
" " " " " four years						420	(502)

*not decided - these should be seen as examples, not recommendations.

While this is a purely hypothetical table, it does allow a glimpse of what Open University broadcasting is likely to be in the mid-1980's: 10-15% of FCE's would have no broadcasts. Allocations will be down slightly on average, for all courses with broadcasting, and down markedly so in one area (Mathematics in this table). The annual production rate would be at a minimum of 280 programmes, if courses were remade every six years, or 420 programmes, if remade every four years. Less than half the courses with any allocation of broadcasting at post foundation level would have repeats, but most Science and Technology courses would get repeats. There would be little room though for expansion in the post-experience area for programmes during the main 32 "academic" weeks of the year.

We can draw a similar picture for radio (Table 6).

Table 6. Possible Steady State Situation in Mid-1980's: Radio

	Post found. FCE's	Post found. FCE's with broadcasts	Ave.no. of progs. (post found.) new	Ave.no. of progs. (post found.) current	No. of progs. (found.)	Total no. of progs. new	Total no. of progs. current
Arts	15	14	24	23	32	368	(392)
Soc. Sciences	16	15	24	25	32	392	(427)
Ed. Studies	10	9	24	24	-	216	(240)
Mathematics	9	8	16	14	16	144	(144)
Science	14	12	16	15	16	208	(233)
Technology	14	12	16	17	16	208	(249)
U	4	4	16	21	-	64	(82)
PE	4	4	24	23	-	96	(92)
Open Forum	-	-	16	32	-	16	(32)
	86(+ 5 found.)	78 (91%)	18.4			1712	1891
Annual production with remakes every six years						285	315
" " " " " four years						428	473

This is a much more hypothetical table than for television. For a start, radio itself is a low resource, and therefore could well be a legitimate part of a low resource course. Secondly, the radio transmission picture may well be better in the mid-1980's, if the new VHF channel is operational. More importantly, though, there is a viable alternative distribution system for audio materials, which could relieve the transmission situation, as we shall see. There is therefore much more room for flexibility in radio policy.

Implications for this Study

We have spelt out the likely transmission situation in the mid-1980's in some detail because it provides a clearer picture of different ways in which alternative media may be useful to the University.

1. If current levels of broadcast programme production are maintained, there is likely nevertheless to be a number of courses without any broadcasting at all. Such courses are also likely to have low student numbers. Alternative media could go some way to filling the gap left by losing broadcasting on these courses.

2. There is likely to be a comparatively large number of courses where, although broadcasting is a component, its delivery to all students on the course by means of off-air transmission cannot be guaranteed. Alternative media could provide a way of getting at least some of the information provided in the broadcasts to the minority of students who miss the transmitted programmes.

3. Alternative media may be used as an extra resource, over and above that of broadcasting, either because of their low cost, or because they have some features which are pedagogically advantageous but which are not features of off-air transmission.

Thus it can be seen that alternative media may well have considerable value to the University, without in any way leading to any reduction in the demand for television and radio facilities.

EXISTING HOME-BASED AUDIO-VISUAL EQUIPMENT

One of the main reasons for using broadcasting in a distance learning system is that it is available to practically everyone in the country, and involves students who enrol in virtually no extra cost in using broadcasting for home-study purposes, since they will already own the equipment and have paid any licensing fees. To what extent though does this universal availability of equipment, and "free" method of distribution (as far as students are concerned) apply to other audio-visual technologies? Table 7 below sets out ownership figures for various items of equipment owned by or easily accessible to Open University students in 1976 (source: Gallagher report on Student Use of Broadcasting, 1977).[1]

Table 7. Equipment Easily Available to Open University Students in 1976

	% of undergraduate students								
	TV set	VHF Radio set	Record player	Tele-phone	Audio-cassette	Colour TV	35mm. slide viewers	Audio-open reel/ cartridge	Video recorder (all types)
All students, 1976.	96%	94%	91%	88%	69%	55%	47%	25%	8%
Farming/mining/manu.	?	?	89%	69%	77%	?	34%	27%	8%

? = no information in 1976

The only pieces of equipment approaching the universal ownership of television and radio sets at the moment are record players and - to our surprise - the telephone. There is however a rapid growth in the ownership of both audio-cassette players (from 57% to 69% since 1974) and colour television sets (from 44% to 55% since 1976). These trends confirm predictions made by the industries themselves. It is likely then that by the turn of the decade most students will have access to VHF radio, record players, telephones, colour television and audio-cassette machines, irrespective of what the University may do. Also, we shall show later that audio-cassette machines and slide viewers are not expensive to purchase. However, in some instances, there may be significant groups of Open University students who will not have some equipment, in particular the telephone and colour television. It will be important then to continue to monitor student access to equipment, to see whether these predictions are accurate.

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1. GALLAGHER, M. Broadcasting and the Open University Student, 1976, Milton Keynes, Open University, 1977.

METHODS OF COSTING

Before we can begin to examine other media in detail, it is important to discuss methods of costing, because considerable confusion or misunderstanding can arise on this matter.

Limits to "Virement" Between Broadcasting and Other A/V Media

When the Department of Education and Science awards its grant to the University, it includes a figure for broadcasting costs. This figure covers the "fixed costs" or overheads, (which, as already mentioned, account for about 77% of the overall figure), plus costs related directly to the number of programmes to be made. In essence, this is the University's payment to the BBC for an agreed level of production and service. Once this figure is agreed, the University is committed to spending it in this way. In very rare circumstances, the BBC has been able to pay back - or rather spend less - than originally anticipated, in the general interests of the University, but in no way can money, once allocated to the BBC, be redirected to the University for other purposes, at least without the BBC's agreement.

Furthermore, it is not easy for the BBC to make large and sudden changes in its level of production. At the request of the Open University and the DES, the BBC production unit at Alexandra Palace is staffed and equipped to operate at maximum efficiency when producing about 300 television and 300 radio programmes per year. Minor savings on the broadcast budget might be made if production dropped below these levels, but there is no guarantee that the DES would agree to such "savings" being used by the University for other purposes, and in any case, dropping the level of production would inevitably increase the average cost per programme, since overheads remain constant. In general, then, there is not much mileage to be gained in looking for savings in broadcast production to pay for other media developments. In any case, we have already indicated that despite the transmission bottleneck, the University will still need a minimum production capacity of more than 280 programmes in a steady state, possibly much more, depending on how quickly it wishes to remake courses and/or programmes.

The implication of this is that the use of audio-visual media other than broadcasting will in general be an additional cost to the University. Alternative media come into competition with broadcasting for funds only if the choice is between increasing broadcasting production substantially beyond 300 programmes a year (for reasons other than remakes), or increasing expenditure on alternative media.

Average and Total Costs

When making comparisons on costings, it is important to use as similar a method as possible for costing different media systems. In practice, though, this is extremely difficult to do. It is important then to understand the basis on which costings are made for each system.

From a decision-maker's point of view, the most important cost is what we have called "total" cost. How much money will it cost to provide teaching through this medium? In 1976, the "total" cost of Open University broadcasting was approximately £3.68 million. This is what was paid to the BBC for its services, and this was meant to cover all the expenses incurred by

the BBC in its OU activities, including overheads. It is much easier to identify the total cost when the service is supplied by another agency, and has to be paid for in full, as with broadcasting. (For this reason, we will use broadcasting in the examples which follow.) Even this example however presents some difficulties. The broadcast costs do not include two very important factors. They do not include the substantial costs which might be charged against the time spent on broadcasting by Open University academic staff. Secondly, the BBC do not charge for the value of air-time. While the £3.68 million includes transmission charges, this covers only engineering and related costs. In France, educational organisations wishing to use the broadcasting system have to pay in addition a price for air-time - what the market would bear for the hire of air-time. In general, in this study we have not included academics' time as a cost, but we shall see that for certain media (but not broadcasting) there is the likelihood of something similar to a charge for air-time having to be paid, which will affect the "total" costs.

A second point regarding total costs is who bears them, or if they are shared, how are these costs split? For instance, in broadcasting, the University (or perhaps more accurately the DES) bears the full cost. The student pays nothing directly, since it can be safely assumed, as we have seen, that students will have television and radio sets (and presumably licences) anyway. In using for instance the telephone, though, costs may be borne either by the student or the University.

We have already pointed out that in most cases, introducing alternative media will require additional expenditure, in that savings from a reduction in current broadcasting levels will not be worthwhile. Thus, total costs are likely to be the first consideration of decision-makers, because no matter how effective a new system may be, it will require either new monies, or giving up some other desired development. The audio-visual replay service in study centres is a good example of this. But total cost, of course, is not the only factor. Generally, the more students that are covered the higher the total cost. Furthermore, no matter how cheap the medium turns out to be, it is still a waste of money if it is not used, or does not lead to the kind of effects that were desired. How can this be taken into account?

One useful statistic is the average cost per student covered by the media. For instance, how much do we spend on broadcasting per student? If we divide the total expenditure on television in 1976 (£3,260,512) by the number of students finally registered (50,944 undergraduates and 4,654 post-experience students), we get the amount spent per student in 1976 (£59). The average allocation of television programmes per FCE is 20.0, and students in 1976 took an average of 1.03 FCE's. Thus an "average" student would be offered (20 x 1.03 =) 20.6 television programmes. Thus the average cost per television programme per student in 1976 would be (59 ÷ 20.6 =) £2.85. This figure can be further refined to a cost per minute of television, by dividing by the length of the programme (so media spread over different lengths of time - 25 minutes for television, 20 for radio - can be compared). Thus television can be calculated as £6.60 per hour per student. However, not all students watch all programmes. In 1976, the Gallagher survey showed that on average students watched 65% of the programmes. Thus, instead of using 20 (the average no. of programmes per FCE), we could substitute 20 x .65 = 13, which is the average number of programmes seen per student. This would give an average cost of £10.80 per hour per student user. One could further refine the statistics to provide average costs per television programme per student per course, or to relate costs to effectiveness by correlating drop-out figures or measures of learning effectiveness, and so on.

There is indeed no limit to the degree of sophistication one might seek in average costing figures, and it is therefore essential to bear in mind constantly the purpose of such calculations. What we are looking for in this study is a common base for comparison, when using average student cost figures. To make comparisons one needs accurate and comparable data for all the media that are to be compared. One of the difficulties in calculating average figures for television and radio is that the bulk of the costs are for programmes being produced in 1976, but not in most cases being transmitted until 1977 or 1978. At the same time, 1976 students are using programmes made and paid for in earlier years. Thus, figures are affected by whether we are dealing with a developing situation or a steady state. When making comparisons, data exist for some media (e.g. student use of broadcasts), but not for others (e.g. likely usage of new systems not yet tried). Thus sometimes we will have to use less precise comparative cost statistics for some media. Lastly, and of most importance, average costs are of course only one aspect of what decision-makers will be looking for. The ease in which a new technology can be introduced, the educational benefits it may bring, the total bill at the end of the day, or even the lack or difficulty of accountancy, may all be more potent factors than average student costs.

Thus average student costs have to be handled very carefully indeed. They can be very misleading, or not meaningful, and as well as looking very carefully at how we have calculated and used average student costs, the reader should also take care himself in using such data. Nevertheless, used carefully, average student costs can be useful data as part of the comparative process.

Breakdown of Costs

Total costs are made up of a number of factors, and there is often inconsistency about what is included in "total" costs.

Education has traditionally been a parasite on technology. The technology is usually developed for other purposes, and then a use for the technology has been found in education. This brings us to a discussion of marginal and development costs. The BBC 2 transmission network had already been set up and paid for, out of licence money, when the Open University was created. The transmission network was already there. Thus, the University has not paid for the development or creation of the network; it is not charged for any of the capital expenditure involved. It pays only the marginal costs that arise from an increased use of an already existing facility. Nor has the University had to invent and develop television transmission and reception equipment.

However, for some of the new media we shall be considering, the University might be required to provide development costs, to get the equipment from the design stage into manufacture and then into the students' homes. Whether or not, when making comparisons, such costs should be taken into consideration will depend on whether or not the University will have to pick up the bill. In general, though, any medium which can piggy-back on existing systems will have considerable cost advantages over systems for which the University must find development costs.

Of all the areas of costs, perhaps the most difficult to cost accurately and meaningfully is production. Production costs also depend on the amount of "slack" or flexibility in the Open University or BBC system. How much additional graphics work could Media take on without adding to the existing staff? How much spare capacity is there in the sound studio in Audio-Visual Services? Furthermore, what should count as production costs? For instance, if a current service is not charged to a course team, should this be included in production costs, even though there may be real costs to the University? As we shall see, some of the media developments require a heavy academic input in production. This might lead to demands for additional academic staff. Should this be counted against production costs?

Increasing the level of production does not necessarily lead to a proportional increase in total costs, especially when overheads form a large part of the costs. Overheads include both direct costs - such as rent, salaries of production staff, maintenance costs - and indirect costs, which are incurred when services elsewhere in an organisation are being used. For instance, included in the BBC "overheads" are charges for services such as legal and copyright services, use of the film library, audience research, and a whole range of other services called on to a greater or lesser extent by BBC/OU productions. Overhead charges are only likely to be increased when production reaches such an unexpectedly high level that individual services cannot cope. Comparatively major fluctuations in production then may have little effect on direct costs, when overheads form such a high proportion of the costs. Conversely, under-production will save very little "real" money.

One of the difficulties we faced in this study was the differences in costing methods for production, both between the Open University and the BBC, and within the Open University itself. It obviously makes sense for an external organisation, such as the BBC, to include the full cost of the operation, including overheads, in its charges to the OU or Government. However, it is also sensible for the University not to charge overheads, such as charges for bursary and personnel services, heating and lighting, depreciation and maintenance of the building, etc., to course teams and other spending units for the use of Audio-Visual Services' facilities, since this would merely discourage spending units from making use of the facilities.

Thus, when making comparisons between BBC and Open University production costs, it is important to remember the difference in overheads charges. This, as we shall see, will be particularly important when comparing audio production costs at Alexandra Palace and Walton Hall. One way of avoiding the problem is to assume production costs to be the same, irrespective of whether the material is produced at Alexandra Palace or Walton Hall. This has the advantage of allowing distribution costs, which do tend to vary in proportion to the level of output, to be compared. On the other hand, if distribution costs form only a small proportion of the production costs, the cost advantages of different methods of distribution can easily be lost due to the large part of the costs made up by production. For this reason, we have in what follows generally kept production and distribution costs separate.

Finally, even though an increased level of production can be absorbed without any increase in overheads, there is obviously a point beyond which production levels cannot be increased without extra costs being incurred, in that extra staff have to be hired, extra equipment bought, etc. Furthermore, BBC overheads do have to be paid for by the University - although these may well be reduced to some extent when the Studio Centre comes on campus - so it would be misleading in indicating general levels of expenditure on various media to exclude production

costs altogether, especially when very expensive production facilities are being made available for courses with very small numbers of students.

Separate from the production of audio-visual material is its distribution. These in turn break down into two kinds of costs. One is "carrier" costs. For broadcasting, these would be transmission costs; for the telephone, the call charge; for media sent through the mail, such as cassettes or photographs, postal and packaging charges. The second is the cost of materials used to "store" the signal - print (for diagrams and pictures), film loops, cassettes. etc.,

Lastly, there are receiver or play-back equipment costs. These are the costs for equipment required in the students' home or study centre to convert the stored or transmitted material into a usable form - a television or radio receiver, cassette player, film-strip viewer, or "decoder" or modem for converting telephone signals.

There is one other factor which we have not included in costs, but which is nevertheless very important, and that is student time and travel costs. We deal with this factor primarily under the heading of educational features of media, on the assumption that anything which provides students with reduced travel (costs and time), and provides choice as to when to use media, is an educational benefit.

So, when discussing costs, it is important to distinguish between additional or replacement costs, total and average costs, development, production, distribution and reception costs, and also to distinguish whether the costs are to be borne by the student or the institution.

AUDIO TECHNOLOGY

Radio

All Open University radio programmes to date have been produced by the BBC. The total number of programmes to be transmitted (at least once) in 1977 is 1,427. These programmes are spread over 108 of the University's 111 courses on offer in 1977.

The three courses currently without radio transmission are M334 (which does not have any audio-visual support), TM281 (which has though 8 flexi-discs), and TD342 (which has transferred its original eight radio programmes on to cassettes and sent them to students in their home experiment kit).

VHF radio transmission covers 98% of OU students, and 94% have suitable sets. In 1976, an average student would listen to 47% of the programmes on his course or courses.

We can calculate the distribution (i.e. transmission) costs of radio per student on courses of varying sizes, as follows:

Table 8. Radio Distribution Costs (at 1976 figures)

No. of students on a course (per year)	100	200	300	500	1000	2000	3000
(% of courses in a steady state)	1%	14%	16%	31%	34%	←4%→	
Per hour (£108 per hour)	£1.08	£0.54	£0.36	£0.22	£0.11	£0.05	£0.04
Single transmission (20 minutes)	£0.36	£0.18	£0.12	£0.07	£0.04	£0.02	£0.01
Per repeat transmission	£0.72	£0.36	£0.24	£0.14	£0.08	£0.04	£0.02
Total - over 6 years - for 16 programmes (rpt.)	£6912	£6912	£6912	£6912	£6912	£6912	£6912
Average cost per student - for 16 programmes	£11.52	£5.76	£3.84	£2.30	£1.15	£0.58	£0.38
Likely no. of users over six years (47%)	282	564	846	1410	2820	5640	8460
Per user per repeat transmission	£1.53	£0.77	£0.51	£0.31	£0.15	£0.08	£0.05

Thus, in a steady state, 1% of the OU courses are likely to have 100 students, or less, 14% will have between 100 and 200 students, and so on. Since transmission costs £108 per hour, the average transmission cost per student per hour in any one year, on a course with 100 students, will be £$\frac{108}{100}$ = £1.08. We shall use costs per hour of material as a standard unit for comparison. However, since a radio programme is only 20 minutes in length, the average cost per student, on a course with 100 students, is 36 pence for a single transmission, and 72 pence for a programme that is repeated. The actual cost paid by the University for transmitting 16 programmes, each of which is repeated, for a course which lasts six years, is £6912 (£72 - the cost of 2 x 20 minutes x 16 x 6 =) This cost is constant, irrespective of the number of students on a course. The transmission cost, per student, for a course with 16 repeated programmes and 100 students a year for 6 years, is £6912 ÷ 600 = £11.52. This is the basis on which all similar, subsequent tables have been calculated.

There is one additional calculation that can be made for radio. Students hear on average only 47% of the radio programmes on their courses. Over six years, 282 students are likely to use a programme on a course with 100 students per year. Thus the distribution cost per user for a repeated programme on a course with 100 students, is £1.53 (£72 ÷ 47). In other words, it is costing £1.53 per student user to transmit each programme (with repeats) on a course with 100 students.

When we come to calculate production costs, the figures are more notional. Although the BBC provided us with the production costs for radio, it was pointed out to us that in practical terms, it was very difficult to assign a "real" cost to the production of a single radio programme. Once the staff and facilities were provided, the level of production could vary substantially without affecting costs to any great extent, particularly if external contributors were not used. As it happened, the radio production component was estimated to cost £329,520 for the 240 programmes produced in 1976, giving an average production cost per programme of £1373. However, production in 1976 was lower than average, so it is possible that average production costs are higher than they would have been at a production level of 300 programmes. However, using the figures provided, we can calculate the production costs of radio per student on courses of varying sizes, as follows:

Table 9. Radio Production Costs (at 1976 figures)

No. of students on a course (per year)	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Per hour (3 programmes) per student	£6.96	£3.48	£2.29	£1.37	£0.69	£0.34	£0.23
Per programme per student	£2.32	£1.16	£0.76	£0.46	£0.23	£0.11	£0.08
Total - over 6 years - for 16 programmes	£21968	£21968	£21968	£21968	£21968	£21968	£21968
Average cost per student - for 16 programmes	£37.12	£18.56	£12.20	£7.36	£3.66	£1.83	£1.22
Likely no. of users over six years (47%)	282	564	846	1410	2820	5640	8460
Per user per programme	£4.87	£2.43	£1.62	£0.97	£0.49	£0.24	£0.16

We can now work out aggregate costs for radio, combining transmission and production costs. The total amount spent on radio in 1976 was £419,376. The amount spent per student on radio in 1976 was (£419376 ÷ 55598 =) £7.54. The average cost per programme per student in 1976 was $\left(\frac{£7.54}{21.6 \times 1.03} =\right)$ 34 pence. The cost to the University of each radio programme, including production and transmission (with repeats) over 6 years, is £1805 (£1373 + £432).

For courses of varying sizes, we can calculate figures as follows:

Table 10. Aggregate Radio Costs (at 1976 figures)

No. of students on a course (per year)	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Per hour (3 programmes) per student	£8.04	£4.02	£2.65	£1.59	£0.80	£0.39	£0.27
Per programme (20 minutes) - repeated	£3.04	£1.52	£1.00	£0.60	£0.31	£0.15	£0.10
Total - over 6 years - for 16 programmes (rpt.)	£28880	£28880	£28880	£28880	£28880	£28880	£28880
Average cost per student for 16 programmes	£48.64	£24.32	£16.04	£9.66	£4.81	£2.41	£1.60
Likely no. of users over 6 years	282	564	846	1410	2820	5640	8460
Per user per programme	£6.40	£3.20	£2.13	£1.29	£0.64	£0.32	£0.21

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It can be seen that on the whole, radio is a very cheap medium. The average cost per programme per student in 1976 was 34 pence, or £5.44 for a course of 16 programmes. Production accounts for 76% of the cost, and thus radio transmission is very cheap, costing on average about 8 pence per programme, per student.

However, as we shall see all through this study, average costs vary enormously, depending on the size of the course. Thus a radio programme on a course with 200 students averages out at £1.50 per student - nearly five times the overall average cost, while on courses with 3000 students, the average cost per student is 10 pence. Fortunately, however, even in a steady state, more than two-thirds of our courses (69%) would be able to provide a radio programme at less than £1 per head, at 1976 prices.

Non-Broadcast Audio Material

Non-broadcast audio material is distributed in three forms: 12" long-play records, which provide up to 50 minutes in playing time; 7" thin plastic flexi-discs, which provide 14 minutes in playing time; and audio-cassettes, which can vary in length up to 90 minutes in playing time. Table 11 indicates the amount of such material (in units equivalent to 20 minutes in playing time) produced so far.

Table 11. Non-Broadcast Audio Material Produced for Courses Presented before or in 1977 (in 20 minute units)

	Produced by OU	Produced by BBC	Total
Records	12.5	40.0	52.5
Flexi-discs	6.2	30.2	36.4
Audio-cassettes	63.0	15.0	78.0
Total	81.7	85.2	166.9

With the exception of the two courses already mentioned (TM281 and TD342), non-broadcast audio material has up to now been used in addition to radio on each course. It is only recently that course teams have considered using a non-broadcast medium in place of radio. (The reasons why some courses have a mixed audio component, and some are using non-broadcast audio material instead of radio, are extremely varied. This matter will be taken up later.)

Because of the varying length of non-broadcast audio material, when calculating distribution costs, we have worked out an average hourly cost, and a cost of providing an amount of time equivalent to 16 radio programmes (i.e. 320 minutes) for a whole course. This leads to what in practice would be an unrealistic course provision (e.g. 6.4 records - either 6 or 7 would be more realistic). However, this does allow for at least a crude comparison for roughly equal amounts in terms of time, for the four audio media.

The first stage in distribution is the same for records, flexi-discs and cassettes. Wherever originated, the master tape recording of the production is sent by Audio-Visual Services to an outside contractor for the production of multiple copies.

If 12" long-playing records are to be produced, a plate master is cut, costing approximately £70. Thereafter, the cost per record depends on the size of the production run. It is generally not economic to manufacture records with runs of less than 1,000. The unit cost of manufacturing records in a run of 1,000 is 42 pence (including the cost of the plate master), and for 10,000,

24 pence. In addition to the records themselves, the University usually provides attractive sleeves. This requires art-work and colour reproduction. The average cost of these sleeves is 10-12 pence each. The records are then packed into cardboard envelopes, which cost 5½ pence each, and postage costs another 10-12 pence per record. The label costs 2 pence per record. Thus the cost for a 50 minute LP, with an initial run of 10,000, is: 53½ pence

24p. + 11p. + 5½p. + 11p. + 2p. = 53½ pence.

In 1976, 87% of the students had a record player. This figure is nearer 100% for courses with records. We do not have figures for usage, but since students are almost certain to receive their record, and can play it when it is convenient for them, we must assume a higher usage than for radio programmes. However, we have not assumed an average user figure, as we have no reliable data on this aspect. On some courses (e.g. A304), students have to buy records themselves. On others, these are supplied by the University (e.g. A241). In the costings that follow, we have assumed that the University will bear the costs.

Table 12. Record Distribution Costs in 1976

No. of students on a course (per year)	100	200	300	500	2000	3000
% of courses in a steady state -	14%	16%	31%	34%	←—— 4% ——→	
Per hour (1.2 records) per student	£0.85	£0.76	£0.73	£0.70	£0.64	£0.59
Unit cost per manufactured record	£0.42	£0.34	£0.32	£0.29	£0.24	£0.59
Sleeve, packing, postage, per record	£0.29	£0.29	£0.29	£0.29	£0.29	£0.29
Total - over 6 years - for 6.4 records (= 16 radio programmes)	£5453	£7258	£11712	£22272	£40704	£56448
Average cost per student for 6.4 records	£4.54	£4.03	£3.90	£3.71	£3.39	£3.14

Once again, production costs for records, flexi-discs and cassettes are more difficult to estimate meaningfully. Some of the non-broadcast audio material has been produced by the Audio-Visual Services Unit at Walton Hall, and some has been produced by the BBC. The production costs of non-broadcast audio materials made by the BBC are not re-charged to course teams. The costs of BBC cassette production (which until this year has been on a modest scale), have been absorbed in the general BBC/OU Production budget. The production of a 20 minute audio-cassette programme is considered by the BBC to be more or less equivalent, in terms of resources, manpower, facilities, etc., to the production of a 20 minute radio programme. Thus, while cassette programmes replace radio programmes, then there are likely to be no additional production costs involved. Should, however the combined production of cassettes, records, and radio programmes substantially exceed 300 programmes a year, there would of course be additional charges to the University. For these reasons, we have assumed in this report that the production costs of cassettes are roughly equivalent to the production costs of radio.

The production costs of non-broadcast materials made by the OU's Audio-Visual Services are not re-charged to course teams. The facility of the OU sound studio and OU sound recordist is made available to an academic course team member at no direct expense to the course team unless considerable travel for the sound recordist is involved. The time spent by the sound recordist on the production of non-broadcast materials is dependent on the length of the

initial script and the amount of editing required. Thus the production of an audio-cassette may take half a day or it may take two days. The OU sound recordist is also involved in a wide variety of other duties, including recording seminars and discussions, making tape/slide programmes, editing developmental tapes and making transfers of audio material. The overall time spent on non-broadcast audio production by the sound recordist is, according to his own estimate, about 20% of his annual workload. Consequently, it is difficult to work out a precise cost for the production of say, 20 minutes of non-broadcast audio material, as these costs are buried in a host of other activities simultaneously carried out by the Audio-Visual Service Unit, with its present facilities and manpower.

It takes almost as much effort, and use of facilities, to produce a 14 minute flexi-disc as a 20 minute radio programme. Similarly, a 50 minute record usually requires roughly the same in effort and facilities as two radio programmes. However, if the record is of music, including either original performances or use of copyright material, production costs can rocket above an average figure, particularly if a full orchestra is involved. Cassettes which involve a lot of integration with printed material, or involve student activities, may also require more preparation than a normal radio programme.

However, we shall make the cautious assumption that production costs are roughly equal - whether carried out at Alexandra Palace or Walton Hall - and the more contentious assumptions that the production cost of a 14 minute flexi-disc is the same as a 20 minute radio programme, a record the same as two radio programmes, and a C60 cassette the same as three radio programmes, on average. We can thus calculate the production costs of records on courses of varying sizes, as follows:

Table 13. Record Production Costs (at 1976 figures)

No. of students on a course (per year)	200	300	500	1000	2000	3000
% of courses in a steady state	14%	16%	31%	34%	4%	
Per hour (1.2 records)	£2.75	£1.83	£1.10	£0.55	£0.28	£0.18
Per record (50 minutes) per student	£2.29	£1.53	£0.91	£0.46	£0.23	£0.15
Total - over 6 years - for 6.4 records	£17574	£17574	£17574	£17574	£17574	£17574
Average cost per student for 6.4 records	£14.66	£9.79	£5.82	£2.94	£1.47	£1.15

The reduction in average production costs for records compared with radio is due to the extra five minutes of time available on one side of a record, compared with a radio programme of 20 minutes length, assuming that the production cost would be the same.

By combining Tables 12 and 13, we can provide aggregate figures for records for courses of varying sizes, as follows:

Table 14. Aggregate Record Costs (at 1976 figures)

No. of students on a course (per year)	200	300	500	1000	2000	3000
% of courses in a steady state	14%	16%	31%	34%	4%	
Per hour (1.2 records) per student	£3.60	£2.59	£1.83	£1.25	£0.92	£0.77
Per record (50 minutes) per student	£3.00	£2.16	£1.52	£1.04	£0.76	£0.64
Total - over 6 years - for 6.4 records	£23027	£24832	£29286	£39846	£58278	£74022
Average cost per student for 6.4 records	£18.20	£13.82	£9.72	£6.65	£4.86	£4.29

FLEXI-DISCS

For flexi-discs, as for records, a plate master is cut (£70). The unit cost of flexi-discs is much lower than for records, being 11½ pence for 1,000, and 5.4 pence for 10,000. While not having such good quality sound reproduction as records, flexi-discs are more robust, and can be slipped into the correspondence packages, thus avoiding separate packaging and mailing costs. As with records, the total cost to the University varies, depending on the number of students on a course. Thus we can calculate the distribution costs of flexi-discs as follows:

Table 15. Flexi-disc Distribution Costs (at 1976 figures)

No. of students on a course (per year)	200	300	500	1000	2000	3000
% of courses in a steady state	14%	16%	31%	34%	← 4% →	
Per hour (4.29 flexi-discs)	£0.73	£0.64	£0.51	£0.39	£0.26	£0.13
Unit cost per flexi-disc per student	£0.17	£0.15	£0.12	£0.09	£0.06	£0.03
Total - over 6 years - for 22.86 flexi-discs	£4663	£6172	£8230	£12344	£12344*	£12344*
Average cost per student for 22.86 flexi-discs	£3.89	£3.43	£2.74	£2.06	£1.03	£0.69

(*For courses with 1,000 students or more, it would be more economical to run off 25,000 copies, because of the sharp reduction in unit costs for such large runs.)

Assuming the production costs of a 14 minute flexi-disc are equivalent to those of a 20 minute radio programme (i.e. £1373), we can calculate production costs as follows:

Table 16. Flexi-disc Production Costs (at 1976 figures)

No. of students on a course (per year)	200	300	500	1000	2000	3000
No. of courses in a steady state	14%	16%	31%	34%	← 4% →	
Per hour (4.29 flexi-discs)	£4.91	£3.27	£1.96	£0.98	£0.49	£0.33
Per flexi-disc per student	£1.14	£0.76	£0.46	£0.23	£0.11	£0.08
Total - over 6 years - for 22.86 flexi-discs	£31387	£31387	£31387	£31387	£31387	£31387
Average cost per student for 22.86 flexi-discs	£26.16	£17.44	£10.46	£5.23	£2.62	£1.74

Production costs for flexi-discs are almost double those for records, because of the assumption that roughly the same amount of production resources is required for a 14 minute flexi-disc as for a 25 minute side of a record.

Combining Tables 15 and 16, we obtain aggregate costs for flexi-discs:

Table 17. Aggregate Flexi-Disc Costs (at 1976 figures)

No. of students on a course (per year)	200	300	500	1000	2000	3000
% of courses in a steady state	14%	16%	31%	34%	← 4% →	
Per hour (4.29 flexi-discs)	£5.84	£3.91	£2.47	£1.37	£0.75	£0.46
Per flexi-disc per student	£1.31	£0.91	£0.58	£0.32	£0.17	£0.11
Total - over 6 years - for 22.86 flex-discs	£36050	£37559	£39617	£43731	£43731	£43731
Average cost per student for 22.86 flexi-discs	£30.05	£20.87	£13.20	£7.29	£3.65	£2.43

AUDIO-CASSETTES

For the audio-cassettes, a tape copy of the material is sent to an outside contractor. The contractor's charges include the cost of each cassette, of copying, of packing each cassette in a plain cardboard box, and of delivery back to the University of all the cassettes. This combined cost for a C60 cassette (i.e. 60 minutes of playing time) is 33 pence. The cost for a C90 is 41.5 pence. (However, we recommend against the use of C90 cassettes, because the thinness of the tape makes it liable to stretch or snap on continual use or on the poorly adjusted, cheap tape decks often used by students.) This price per unit is constant, irrespective of the size of the run. Cassettes can be sent to students in a variety of ways: in home experiment kits, with correspondence units, or separately in their boxes. The postage of the latter is 6½ pence. It is difficult to be precise in calculating the marginal costs of the handling charges for this operation, but 2½ pence per cassette, we are assured by Operations would be more than generous. Thus the cost for a C60 cassette is: 33p. + 6½p. + 2½p. = 42 pence. Thus we can calculate the distribution costs of cassettes as follows:

Table 18. Cassette Distribution Costs (at 1976 prices)

No. of students on a course (per year)	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Per hour (1 C60 cassette)	£0.42	£0.42	£0.42	£0.42	£0.42	£0.42	£0.42
Unit cost per C60 cassette	£0.33	£0.33	£0.33	£0.33	£0.33	£0.33	£0.33
Handling and mailing	£0.09	£0.09	£0.09	£0.09	£0.09	£0.09	£0.09
Total - over 6 years - for 5.33 cassettes	£1343	£2686	£4029	£6716	£13432	£26863	£40295
Average cost per student for 5.33 cassettes	£2.24	£2.24	£2.24	£2.24	£2.24	£2.24	£2.24

Assuming the production costs for a C60 cassette are equivalent to those of three 20 minute radio programmes (i.e. £1373 x 3 = £4119), we can calculate cassette production costs as follows:

Table 19. Cassette Production Costs (at 1976 figures)

No. of students on a course (per year)	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Per hour (1 C60 cassette) per student	£6.86	£3.43	£2.29	£1.37	£0.69	£0.34	£0.23
Per cassette per student	← as above →						
Total - over 6 years - for 5.33 C60 cassettes	£21954	£21954	£21954	£21954	£21954	£21954	£21954
Average cost per student for 5.33 C60 cassettes	£36.59	£18.29	£12.20	£7.32	£3.66	£1.83	£1.22

Combining Tables 18 and 19, we obtain aggregate costs for cassettes:

Table 20. Aggregate Cassette Costs (at 1976 figures)

No. of students on a course (per year)	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Per hour (1 C60 cassette)	£7.28	£3.85	£2.71	£1.79	£1.11	£0.76	£0.65
Per cassette per student	← as above →						
Total - over 6 years - for 5.33 C60 cassettes	£23297	£24640	£25983	£28670	£35386	£48817	£62249
Average cost per student for 5.33 C60 cassettes	£38.83	£20.53	£14.44	£9.56	£5.90	£4.07	£3.46

Other Cost Factors

In these costings, we have deliberately excluded a number of factors. First of all, we did not think it worthwhile to examine the cost differences that would occur if students were asked to return records, flexi-discs or cassettes after use, for re-issue to other students in subsequent years. All these distribution systems are so comparatively low cost that the considerable operational and administrative costs that would arise from checking, storage, enforced collection, and replacement of damaged materials would more than outweigh any savings that might be made.

Secondly, we have not taken account of the audio-cassette library service provided for students in 1977. Briefly, if a student misses a radio programme, he can send a card to Audio-Visual Media Services, and receive, free of charge (except for a stamped, addressed envelope), a cassette copy of the programme. At the time of writing, (end of May), 11,760 programme requests were received, and the estimate is that by the end of the year, 26,000 programme copies will have been made. This scheme costs an estimated £10,000 per year to run. This will work out at 38 pence per programme copied, or with 1,427 programmes to be transmitted, an extra £7 to be added to the total costs to the University, per programme (i.e. £301 + £7). However, we will not be taking these costs into account when making comparisons.

Thirdly, the University has an agreement with the BBC to use 30 hours a week transmission time, but is using only 26 hours 05 minutes per week, thus limiting the scope for repeats. If the University did use the full 30 hours a week, it would have to pay another £13,000 per year approximately for the additional transmission costs. Thus one might look at the £10,000 on the audio-cassette library system almost as a replacement for the £13,000 "saved" on the reduction in transmission times, overcoming to some extent the problems caused by loss of repeats, or inconvenient transmission times.

Perhaps most important of all, we have not included the usually substantial costs of accompanying visual materials, such as broadcast notes, media booklets, film loops, etc. We will be dealing with these in a later section, and in general (though there are exceptions) these costs are relatively independent of the particular sound medium being used in conjunction with visual materials.

Comparative Costings

We can now make a comparison of costs between the different audio media, for different course populations (assuming a course life of six years). The two main statistics we shall use will be the total cost over six years of using 320 minutes' worth of various audio media (equivalent to 16 radio programmes in length) and the average cost per student for one hour's worth of audio material. We also separate costs into distribution and aggregate costs.

Table 21. Comparative Total Costs of Distribution for 320 minutes of Audio Material

(rounded to nearest £100)

No. of students on a course	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Radio (with repeats)	6900	6900	6900	6900	6900	6900	6900
Radio (without repeats)	6300	6300	6300	6300	6300	6300	6300
Records	-	5500	7300	11700	22300	40700	56400
Flexi-discs	-	4700	6200	8200	12300	12300	12300
Cassettes	1300	2700	4000	6700	13400	26900	40300

From this table, we have plotted Figure 1. (over)

Table 22. Average Distribution Cost Per Student For One Hour of Audio Material

No. of students on a course	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Radio (with repeats)	£2.16	£1.08	£0.72	£0.44	£0.22	£0.10	£0.08
Radio (without repeats)	£1.08	£0.54	£0.36	£0.22	£0.11	£0.05	£0.04
Records	-	£0.85	£0.76	£0.73	£0.70	£0.64	£0.59
Flexi-discs	-	£0.73	£0.64	£0.51	£0.39	£0.26	£0.13
Cassettes	£0.42	£0.42	£0.42	£0.42	£0.42	£0.42	£0.42

Table 23 compares aggregate costs (i.e. the costs of distribution and production).

Table 23. Comparative Aggregate Costs for 320 minutes of Audio Material

(to nearest £100)

No. of students on a course	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Radio (with repeats)	£28900	£28900	£28900	£28900	£28900	£28900	£28900
Radio (without repeats)	£25400	£25400	£25400	£25400	£25400	£25400	£25400
Records	-	£23000	£24800	£29300	£39800	£58300	£74000
Flexi-discs	-	£36000	£37600	£39600	£43700	£43700	£43700
Cassettes	£23000	£24600	£26000	£28700	£35400	£48800	£62200

From this table, we get Figure 2. Clearly radio is the cheapest medium for courses with more than 500 students, whether or not production costs are included. Since costs for cassettes and records escalate rapidly for courses with more than 500 students, there are strong economic reasons for concentrating radio on courses with large student numbers.

Secondly, for courses with less than 500 students, cost differences - at least for distribution - are comparatively small, ranging from a total distribution cost over six years of £6,300 for non-repeated radio programmes to £11,700 for records. Thus for courses with substantially less than 1000 students, the differences in costs are so small as to be safely ignored when considering choice of an audio medium.

FIGURE 1 AUDIO MATERIAL

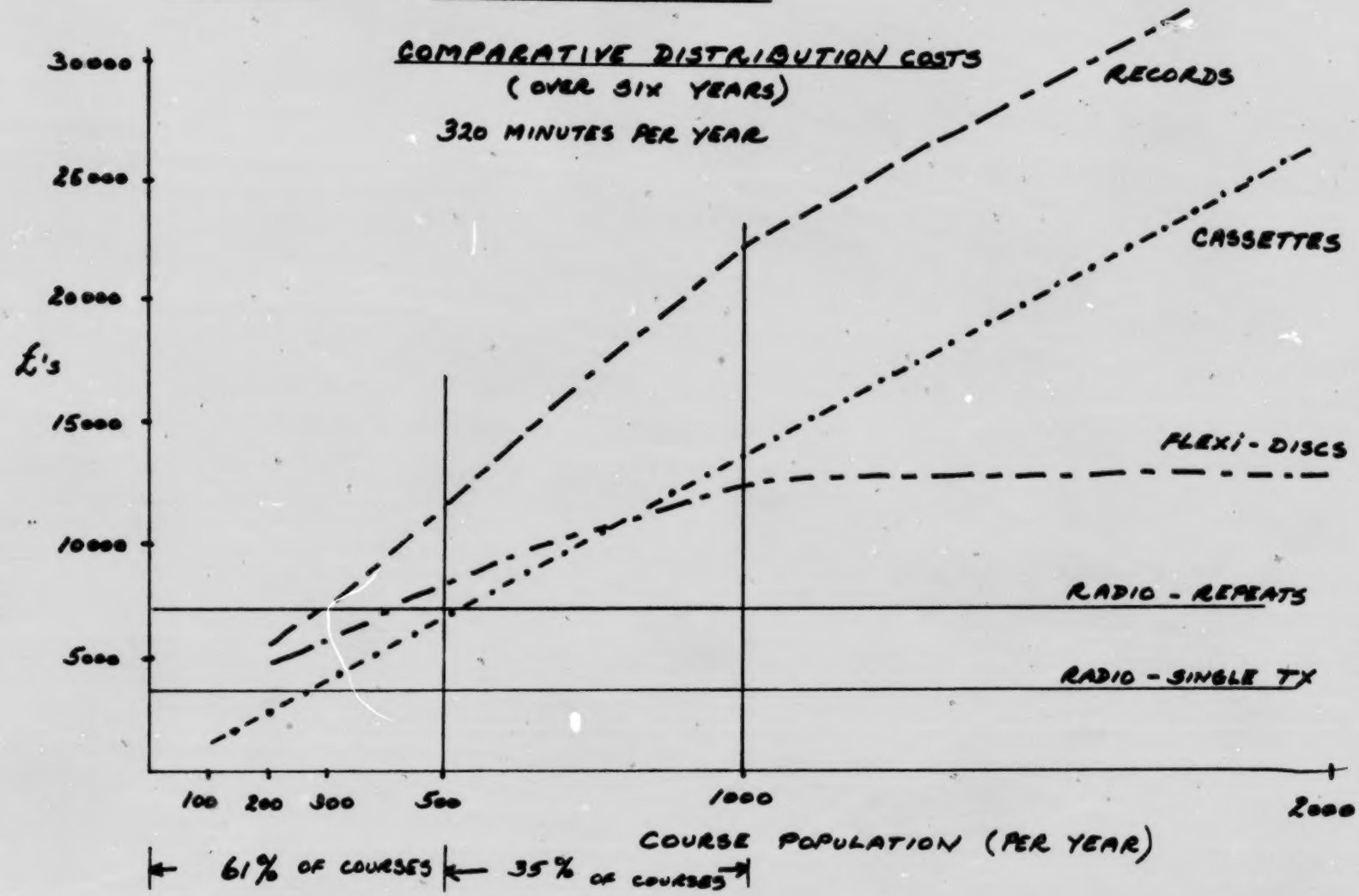
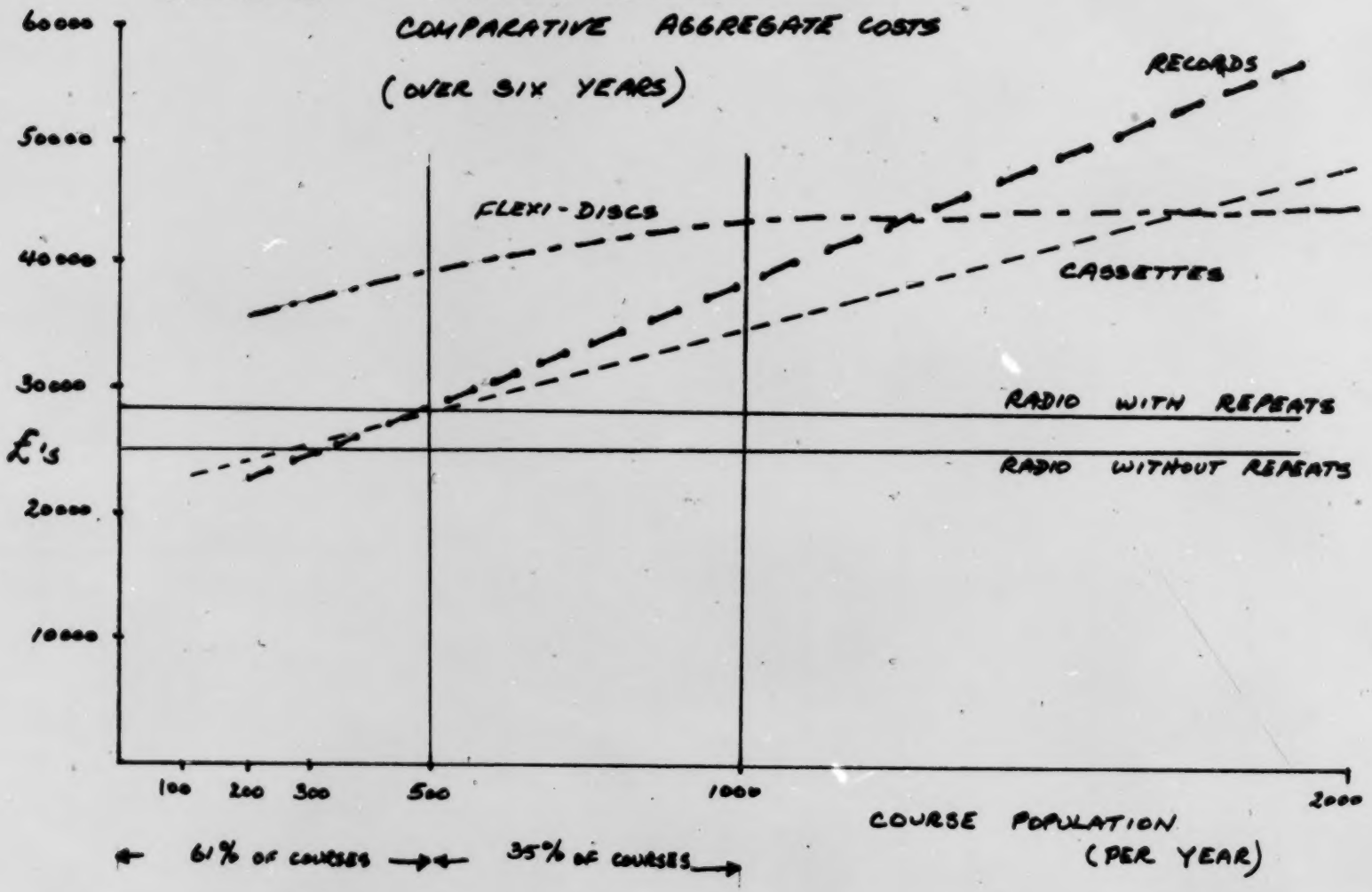


FIGURE 2 AUDIO MATERIAL

COMPARATIVE AGGREGATE COSTS

(OVER SIX YEARS)



With regard to distribution costs, records are clearly more expensive, irrespective of the size of the course, and involve substantial costs for courses of 1,000 students or more, exceeding £50,000 for a large course. There is little difference between cassettes and flexi-discs for courses with less than 1000 students, at which point the advantages of mass production make flexi-discs a more economical proposition. In fact, even for large courses, the cost difference between distributing audio material on radio or flexi-discs is less than £1,000 a year.

However, it can be seen that separating distribution and production costs radically affects the cost relationships between different media. There are two general reasons for this. Distribution costs are a minor part of aggregate costs for all media. Secondly, the assumptions about production costs lead to marked differences between media in costs per hour. Although the difference between 14 minutes (for a flexi-disc) and 25 minutes (for a record side) does not seem very much, for the same production effort one is obtaining 78% more material, if this assumption is correct. Thus the aggregate costs for flexi-discs are pushed up considerably, while those for records are substantially reduced.

We think there are serious limitations in taking production costs, at present, into consideration when making decisions about appropriate audio media. At the moment, while the total audio production remains not too far in excess of the equivalent of 300 radio programmes a year, it makes virtually no difference to production costs whether programmes are produced as radio, cassettes, records or flexi-discs. What the University does have to pay money for, in direct relation to the amount of material produced, is the form of distribution. We are also sceptical of the usefulness or accuracy of our own assumptions about audio production costs. As average figures, and ways of allocating overheads to programmes, the figure of £1,373 for 20 minutes of radio material is no doubt correct. We doubt however whether it actually does cost £4,119 to produce 60 minutes-worth of cassette material. Flexi-discs need not be produced in 14 minute "chunks", but in longer (or shorter) chunks, then distributed on 14 minute discs. For this reason, therefore, while cassettes, records and flexi-discs are accommodated within current levels of audio production at no extra cost to the University, it is the distribution cost curves which have the greater validity.

However, we believe that the production cost figures do have some value for the University. We believe that course teams will increasingly want to use non-broadcast audio media, either in addition to or instead of radio. For instance, if all radio programmes were repeated, if foundation courses received 32 radio programmes each, and if all other courses (48) with more than 500 students received an average of 16 programmes each, there would be left sufficient radio transmission time for only another 20 courses (each with 16 programmes), leaving 64 courses (all with less than 500 students) without radio - yet every one of the currently available radio slots would be filled. This would still require an annual production load of 235 radio programmes (on a six-year remake cycle). To provide 320 minutes worth of non-broadcast audio material for each of the remaining 64 courses would require the equivalent of another 170 "programmes", or a total production capacity of 405 programmes, even if courses did not use radio and non-broadcast audio material (as a number are doing already). Although these figures are crude, they do provide support for the view that in the not too distant future, the production of audio material will exceed the present capacity, and thus is likely to involve the University in additional costs.

The question then arises: what should be the basis for such costs? This is obviously a subject for discussion in the joint OU/BBC management group, and will also be affected by the capacity of, and the agreement arranged for, the new studio centre. However, even if additional production costs for non-broadcast audio media were to be incurred, these would be the costs of marginally increasing production levels (e.g. costs of salary for extra producers) and would not involve full, additional overheads charges. Consequently, the cost to the University for additional programmes beyond current capacity, if made by the BBC, would be substantially less than the "average" production figure of £1,373 a programme.

Educational Criteria

Comparing audio media on the basis of cost alone assumes that each medium has the same educational features as the others. This is not so, and in this section, we will attempt to set out some of the educational advantages and disadvantages of each medium.

Any attempt to list the educational features of a medium is bound to be incomplete since it is impossible to document all the ways in which a particular medium can be used. New ways of using a particular audio medium occur with almost every new course which is mounted by the Open University. The large scale use of audio media such as cassettes for distance education is a comparatively new phenomenon. However, we will attempt to concentrate on the features that we see as being particularly unique to each audio medium, and which would not normally be effectively transferable from one medium to another. At the same time, we recognise the inadequacy and subjectivity of what follows, and we believe that the University would benefit from widespread discussion about the educational differences between radio, records, discs and cassettes by those concerned with the design, production and use of audio materials.

Radio

In its evidence to the Annan Committee, the University listed a number of functions for radio. However, a number of these are equally applicable to other audio media, and the number of features unique to radio is much smaller, though nevertheless important.

1. Since radio is broadcast at specific times during the year, and usually at regular intervals, it can be used as a pacing device to remind the student of how far he should have progressed with other course material. Some research indicates that television and radio do not have such a strong pacing effect as was originally thought (the assignment dates being the main pacers) but nevertheless radio can act as a useful reminder to students to move on to the next part of the course, or as a "taste " of what is to come, if students are behind in their work.

2. A radio programme can be remade very quickly and distributed to students right up to the last minute. This provides radio with several advantages:

   (a) it can provide remedial tutorials, or some other form of tutorial, based on feedback, or on students' actual problems;

   (b) it can provide corrections, alterations or up-dating of material, where remake budgets are limited, or where print would be too slow or costly;

(c) it can relate current events to course materials, at the time a student is studying a course, such as political events, news stories and social, environmental and industrial developments. A radio programme can bring in new people with alternative or relevant views on some of the topics covered in a course, particularly in its second and subsequent years.

3. Radio can be used where only one hearing of the material would generally be considered sufficient. This might cover a number of circumstances:

(a) an introduction, summary, or overview of a unit or block.

(b) a discussion, where the raising of issues and counter-views is considered to be more important than the actual arguments themselves.

(c) where an experience - such as a performance of music, a dramatisation, a poetry reading - is considered to be of more value than an intellectual analysis of concepts, or the provision of information.

(d) a single argument or story, again where analysis of the argument or story is less important than familiarising the student with the argument or story, or reinforcing ground covered elsewhere in the course.

4. Some hold the view that radio provides students with a feeling of communality, with the realisation that at one particular point in time many other students on a course are sharing the same experience.

5. Because it is possible to record radio material easily, it is possible for radio material to be stored, re-used and accessed, provided that the student can either record the material himself, or obtain cassette copies through the audio-cassette replay scheme, or from other sources, such as family, friends or tutors.

6. An early evening programme can break the inertia of studying, and get a student working.

No doubt other features which are unique to radio could be proposed. However, radio does have some major disadvantages with respect to other audio media:

1. In terms of getting audio material to a circumscribed body of students who are usually part-time students and full-time workers (some on shift-work) radio transmission is not 100% efficient; some students will inevitably not be available to receive the transmission (even if there are two transmissions). If only one transmission is made it is likely that at least 20% of the target audience will miss receiving that off-air transmission.

2. Since a radio programme is transmitted in real time it is not possible for the student to stop the programme, go back, move it forward or go over the material several times.

3. The pace of a radio programme is the same for all students, regardless of differences in ability.

4. A radio programme, unless recorded for play-back at a later date, is transitory. Without a recording facility the programme is not retrievable except through memory.

5. Because of the times at which OU radio programmes are often broadcast, (such as the early morning, early evening and late night), students may find it difficult or impossible to listen, or if they do, to concentrate or carry out immediately following a programme the activities and readings designed to reinforce the programme and integrate it with the rest of the course.

Other audio media

Audio-cassettes, flexi-discs and records have several common advantages over radio.

1. They can be delivered through the post and therefore 100% delivery to students can be more or less guaranteed.

2. Since the student can stop, go backwards/forwards, and replay when and where he wishes, the audio material can be more dense or concentrated than on radio and consequently the student can introduce his own appropriate pacing.

3. These media can be more easily used than radio in conjunction with a wide variety of still visual, graphical material and real objects (rock samples, HEK's etc.) and used over an extended period of time.

4. By utilizing the stop/start function, cassettes, discs or records can be used in a programme learning style whereby the student stops after being given an explanation of how to carry out a specific activity then returns to start the cassette/disc/record to compare his results with the answer provided.

5. These media can be used to encourage mastery learning of basic concepts fundamental to a discipline. They can be used not only for the initial learning of concepts/skills but can be used in a remedial manner by the student.

6. Academics can have more control over the production process, ensuring a closer integration between the audio and printed materials. The audio materials can be directly integrated with the correspondence texts themselves, and the academic, using a tape recorder, can construct and develop the ideas for the audio, print and other visual components at the same time, confident that the student can use the various components in the way that he has planned.

The disadvantages of the cassettes, discs and records tend to be the mirror image of the advantages of radio. In particular:

1. They can be remade for following years but last minute changes or alterations etc. cannot be handled. Handover to the contractor needs to occur some considerable time before the cassettes are to be sent to students.

2. With these other audio media, the onus is on the student to use them when he is ready to use them. In other words, the pacing (in terms of when he uses, for example, cassettes) is determined by the student and not by a transmission on a specific date. Furthermore the student must determine his own pace for working through the material e.g. when he should stop, re-listen, etc.

3. Not all students have cassette recorders or record players and it will be necessary for some students either to buy equipment, or to borrow it from a Study Centre, if that is possible (as it is for cassettes).

4. Cassettes may be produced without producer (or other academics) involvement, and as a result, material may not be checked for errors of fact, bias, or for unclear presentation.

Differences between cassettes, discs, and records

Both records and flexi-discs have a slight advantage over cassettes in that, by the use of spaces in the grooves, the material can be broken up into sections which the student can identify by eye, enabling him to find material slightly more quickly. On the other hand, the maximum length of a flexi-disc is only 7 minutes a side, limiting the number of useful divisions, and the length of "treatment". Long playing records give excellent, high fidelity sound, and are therefore particularly appropriate, of course, for music and its analysis, especially since the loud speakers for record players are usually of a higher quality than those of portable cassette players. Flexi-discs do not have such high quality sound, and damage more easily than records. Records can also be easily damaged, and cassettes are much more robust and portable, and less likely to be damaged by stopping and starting during the "programme" or by clumsy operation. We shall also see later that cassette machines can be used for other purposes. All three media provide adequate sound quality for speech.

Production considerations

It should be clear from this that these other media are not straight alternatives to radio, but require quite different production techniques. These media should be used in quite different ways to radio. Using a standard "radio" format of an unbroken, continuous "programme" for a cassette is to ignore many of the cassette's educational advantages. The timing and pacing, the purposes for which cassettes and records can be used, the way they can be used in conjunction with accompanying printed or visual materials, the amount of information, the length, and even the language used, will all be different from radio.

Furthermore, the availability of cassettes or discs together with radio should have an influence on the function of the radio programmes themselves. In short, cassettes, records and discs can carry a much heavier instructional role, freeing radio for complementary roles, such as updating material, providing feedback, news and information on the course, discussion of assignment and examination questions, and similar, transient functions. We foresee such programmes having possibly a magazine format, and being more participative, drawing on students, tutors and academics from other institutions - indeed, more closely resembling some aspects of general broadcasting, but geared to the needs of a specific course.

Finally, because of the availability of cheap, alternative sound media, we believe that the number of radio programmes for transmission should be gradually reduced, so that nearly all radio programmes can be repeated. Radio should be concentrated on courses with larger student numbers. For courses with low student numbers, radio should be used more sparingly, and in the manner suggested above, in conjunction with cassettes or records. On some courses, it should not be used at all.

We believe therefore that there is considerable scope for an increase in the use of non-broadcast audio media. While this may be accompanied by some reduction in the quantity of radio programmes for transmission, it should lead to a sharpening of focus on the function of radio, and should lead, we believe, to a more lively and interesting use of the medium.

AUDIO-VISUAL TECHNOLOGY

TELEVISION

All Open University television programmes to date have been produced by the BBC. The total number of programmes to be transmitted (at least once) in 1977 is 1,440. These programmes are spread over 109 of the University's 111 courses on offer in 1977. The two courses currently without television programmes are A402 and M334.

At mid-1976 prices, the BBC television production costs were £2,849,792 for the 253 programmes produced in 1976, or an average programme production cost of £11,264. Television transmission costs were £151 per 25 minute transmission, at a total annual cost of £410,720. The total amount spent on television in 1976 was £3,260,512. The amount spent per student in 1976 on television then was £59 $\left(\frac{£3,260,512}{55,598}\right)$. The average cost per programme per student in 1976 was £2.85 $\left(\frac{£59}{21.6 \times 1.03}\right)$.

BBC television transmission covers 97% of OU students, and 96% have suitable sets. In 1976, an average student would watch 65% of the programmes on his course or courses.

We can calculate the distribution costs of television per student on courses of varying sizes, as follows:

Table 24. Television Distribution Costs (at 1976 figures)

No. of students on a course	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	⟵ 4% ⟶	
Per hour (£362.4)	£3.62	£1.81	£1.21	£0.72	£0.36	£0.18	£0.12
Per single transmission (25 minutes)	£1.51	£0.75	£0.50	£0.30	£0.15	£0.07	£0.05
Per repeat transmission	£3.02	£1.50	£1.00	£0.60	£0.30	£0.14	£0.10
Total - over 6 years - for 16 progs. (rpt.)	£28992	£28992	£28992	£28992	£28992	£28992	£28992
Average cost per student for 16 programmes	£48.23	£24.16	£16.10	£9.66	£4.82	£2.42	£1.62
Likely no. of users over 6 years (65%)	390	780	1170	1950	3900	7800	11700
Per user per repeat transmission	£4.65	£2.32	£1.55	£0.93	£0.46	£0.23	£0.15

Even on courses with only 200 students, television transmission costs average only £1.50 per student per programme, and only 10 pence per programme per student for courses with 3,000 students. These costs are extraordinarily cheap, when compared with £8 for a single, blank 30 minute video-cassette, or £12 for 25 minutes of monochrome super-8mm. film cassette. Even for the smallest courses, television transmission is far cheaper than any other form of video or film distribution.

As with audio materials, television production costs are much more difficult than distribution costs to calculate meaningfully. Once the staff and facilities have been provided, the level of production can vary substantially around the figure of 300 programmes without affecting overall costs to any great extent, although an "average" programme will still incur something like £2,600 in direct expenditure (i.e. expenditure that would be saved if the programme was not made). If however direct costs and overheads are averaged out over the 253

programmes produced in 1976, the average programme production cost is £11,264. As for radio, the average cost per programme would have been lower had production in 1976 been nearer to 300 programmes. Although presumably the "shortfall" of 47 programmes would have reduced broadcast expenditure by something like £122,000 in 1976, this would have been an increase of merely 4.3% on the overall production expenditure.

Table 25. Television Production Costs (at 1976 figures)

No. of students on a course	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Per hour (2.4 programmes)	£45.05	£22.53	£15.02	£9.01	£4.51	£2.25	£1.50
Per programme per student	£18.77	£9.39	£6.26	£3.75	£1.88	£0.94	£0.63
Total cost - over 6 years - for 16 progs.	£180224	£180224	£180224	£180224	£180224	£180224	£180224
Average cost per student for 16 progs.	£300	£150	£100	£60	£30	£15	£10
Likely no. of users over 6 years	390	780	1170	1950	3900	7800	11700
Per user per programme	£28.88	£14.44	£9.62	£5.78	£2.89	£1.44	£0.96

By combining Table 24 and Table 25, we can calculate aggregate costs for television (Table 26).

Table 26. Aggregate Television Costs (at 1976 figures)

No. of students on a course	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Per hour (2.4 programmes)	£48.67	£24.34	£16.23	£9.73	£4.87	£2.43	£1.62
Per programme (25 minutes) per student	£21.79	£10.89	£7.26	£4.35	£2.18	£1.08	£0.73
Total - over 6 years - for 16 progs. (rpt.)	£209216	£209216	£209216	£209216	£209216	£209216	£209216
Average cost per student for 16 progs.	£348	£117	£116	£70	£35	£17	£12
Likely no. of users over 6 years (65%)	390	780	1170	1950	3900	7800	11700
Per user per repeat transmission	£33.50	£16.76	£11.17	£6.71	£3.35	£1.67	£1.11

Thus it costs about £200,000 to provide a course with 16 television programmes, although for a course with more than 2,000 students a year, the total cost is less than £1 a programme per student. Even for a course with 500 students a year, the cost per programme per student is only £4.35 (again, this should be compared with £8 for a blank video-cassette). However, average costs escalate rapidly as student numbers drop below 500. For a course averaging only 200 students a year, the average cost per programme per student has risen to over £10, or over £160 per student for a course with 16 programmes, and there are already several courses in this position in 1977.

However, these figures have to be treated with caution. Whether or not studios are used or programmes made, staff have to be paid, rental and maintenance charges found, and equipment kept in working condition. Even though there may not be many students on a course, it is still better to use the production staff and facilities to make programmes for such a course, if there are no other courses with large student numbers being produced by the University. There are only two ways of bringing down average programme costs per student on an individual course. One is to allocate more programmes to courses with large student numbers, hence leaving less of the remaining production capacity for the smaller courses. The other is to get rid

of courses with low student numbers, thereby freeing television - and other - resources for use on other courses, and forcing up student numbers on the remaining courses, by narrowing student choice. What cannot be done is to save substantial costs by making "cheap" programmes for courses with low student numbers, nor to use the "television" money "spent" on such courses for other purposes.

In any case, the overall average cost per programme per student is currently still a modest £2.85, although this will increase to some extent, even without inflation, as the University approaches a steady state. Nevertheless, it is salutary for the University to be aware of the effect on average programme costs of courses with low student numbers, and in particular how the reduction in course size from 500 to 100 leads to a staggering rise in the average cost per student (£70 to £348) for 16 television programmes. Whatever the educational reasons for using television on courses with 300 students or less, it is not a sensible use economically for such an expensive and scarce medium.

VIDEO-CASSETTES

There is, at the time of writing, no operational scheme in the University to provide video-cassette copies of programmes for students, although Planning Board has agreed in principle to such a proposal, and a scheme has been piloted in the South Region.[1]

Video-cassette or cartridge machines cost between £500 and £1,200 each, although the machine recommended by a University Steering Group for use in study centres would cost about £800. A 30 minute cartridge for this machine would cost about £10.

Because of the high cost of machine and cassettes, it is not feasible to consider use of video-cassettes in students' homes. However, the University has agreed in principle to a library system. In this scheme students would be issued with cards for requesting a programme. The card would be sent to Audio-Visual Services at Walton Hall, which would send a cartridge copy of the programme to a named study centre. The student would view the cartridge at the study centre, either individually or in a group, then return the cartridge to Walton Hall, for re-use.

The cost of a national video-cassette scheme would vary, depending on how many centres were covered. A minimum scheme, covering 35 study centres, and just over half the students, would cost £90,000 in capital expenditure and £47,000 in recurrent expenditure. A fully national scheme, covering all study centres, would cost about £180,000 a year to run (including depreciation). Had a full scheme been operational in 1976, it would have cost an additional £3.24 per student, making the average "television" cost £61.88 per student per year, or an increase of 5.5% on the cost of television.

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1. GALLAGHER, M. and MARSHALL, J. Report on the VCR Scheme, 1974-1975, Milton Keynes, Open University, 1976.

It is interesting to note that Gallagher has found that access to a video cartridge machine, during the piloting in 1976 in the South Region, led to a 9% increase in viewing figures.[2] The cost per user per programme thus would be reduced from £10.80 per hour to £9.00 per hour, and the annual average cost per student user would decrease from £93 to £82. If we add the £3 per student due to the additional VCR costs, we still find, at £85, that average student user costs would be reduced by £8 per year by the introduction of a video-cassette system, due to an increase in viewing.

However, this would not be a "cash" saving, and it is the additional total costs of £180,000 per annum which are proving too high for the University at the moment.

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2. GALLAGHER, M. Broadcasting and the Open University Student, 1976, Milton Keynes, Open University, 1977.

AUDIO-VISION AND RADIO-VISION

We define audio-vision as the simultaneous use of separate audio and visual media. The sound component may be in the form of radio, cassette, record or flexi-disc. The associated visual material may be in the form of print, charts, diagrams, pictures, graphs, slides, film strips or samples of materials (rocks, experimental equipment, etc.) Basically, the audio channel is used to talk the student through the visual material. Frances Berrigan and Anne Gibson, of IET, have just completed a survey of audio-vision at the Open University,[1] and we have drawn heavily on this study in this section.

Radio-Vision

With radio-vision, students are required to undertake activities based on visual media while listening to the broadcast. Hence the student has to follow through the illustrations at a continuous and pre-determined pace, over a set period of time (20 minutes), at a particular point in time (i.e. when the programme is being transmitted). Berrigan and Gibson found that the use of radio-vision has increased significantly over the last three years. In 1977 64 courses were using some form of radio-vision programme, involving altogether 292 radio programmes (20% of all programmes). There is a wide variety of visual media used on these radio-vision programmes, as can be seen from Table 27.

Table 27. No. of Programmes and Courses Using Radio-Vision in 1977

	Programmes in:								
Visual material located in:	Arts	Social Science	Ed. Studies	Maths.	Science	Tech.	P-E	Total	No. of Courses
Supplementary material only	13	10	12	88	40	19	8	190	43
Broadcast or A/V handbooks	26	7						33	4
Correspondence texts	2	1	1	7	13	5	-	29	16
Set book	4			2	3	1		10	9
Case study folders			1		2	2		5	5
Large size maps/posters	4	5	1		3			13	5
Postcards	8							8	2
Film-strip, slide reels					5				2

Non-Broadcast Audio-Vision

Non-broadcast audio-vision (using cassettes, records, or discs as the sound component) enables the student to stop the audio playback, answer a question or carry out some exercise then restart the tape or disc. Thus the student can determine his own pace of working through the material to locate a section, and since he has his own copy of the material, he can use it whenever he wishes.

1. BERRIGAN, F. and GIBSON, A. Radio- and Audio-Vision at the Open University, IET Papers on Broadcasting, Paper no. 82, 1977.

Non-broadcast audio-vision has been used on a smaller number of courses than radio-vision, (such as A304, DT201, SM351, TM281), usually in addition to radio.

The Visual Component

The visual material may take a number of forms. By far the most common is the use of printed, supplementary material. On a few courses (A305, DT201, for instance), separately produced, well-illustrated audio-visual or broadcast booklets have been published, in addition to the usual correspondence texts and supplementary material. Some courses (e.g. A321, E203, A351) have used maps, charts, posters, or display sheets. Others (e.g. S22-, S333) have used filmstrips, or even stereoscopic aerial photographs (S333).

A more elaborate form of audio-vision - slide/tape programmes - is being used in many British higher education institutions, such as Lanchester Polytechnic, Queen Elizabeth College, London, and the Chemical Society. Some of these slide/tape programmes have more recently been designed for individual student use in University media resource centres or with small slide viewers in the student's home. The advantages of 35mm. slides is in their high quality, full colour reproduction and in the wide variety of material which can be put on to still film: micro-photography, aerial photography, historic paintings, etc. Since the slides/filmstrips can be used sequentially to show, for example, stages of plant growth, growth of bacteria, etc., a simple form of animation is possible.

Educational Features of Audio-Vision

Obviously, there is a difference between those programmes which the student will hear off-air (radio-vision) and those where the student has control over the sound source. In the former, far less material can be included, and more care has to be taken over pacing, and due regard has to be given to concentration levels.

Another consideration is the different approach to production. Berrigan and Gibson found in their study that, on the whole, techniques for the production of the audio component in these packages have not been well developed so far. More stress has been placed on the visual component, while the sound side has followed broadcast techniques. More care has to be given to the span of attention, comprehensibility, phrasing, density of content, and the time allowed for student tasks.

The advantages of non-broadcast audio-vision are varied, but perhaps the most important is flexibility. That is, students can be provided with the sound and visual components and make use of them when appropriate or relevant to an individualised study programme. Another advantage is permanence. Unlike off-air broadcasting, the materials are available for revision, and for replay as often as required. These two features make non-broadcast audio-vision a more suitable medium for the teaching of skills or mastery learning (e.g. where the process of examining the visual component is a skill which the student needs to acquire, or where practice is involved, to fully master a concept or skill).

It may also be a more suitable medium for direct teaching than off-air broadcasting. Because the student has easy reference to the material, it is possible to include more content in audio-vision packages than in broadcasts which the student hears or views once only. 50

At the same time, because the materials are placed in the hands of the learner, it can be guaranteed that all students have the opportunity to learn sections of the course. Again, because some students unavoidably miss broadcasts, the same guarantees cannot be given for radio-vision.

The opportunity given by audio-vision to provide denser material has its own drawbacks. The tendency is for audio-vision to be allocated the same proportion of student study time as radio or television. However, many of the packages require replay several times if full benefit is to be gained. The amount of time taken to work through some audio-visual packages can be three or four times greater than for off-air broadcasts. This is particularly so when the objective is the acquisition of a skill or technique. Allowance for this additional workload has to be made, and deducted from time allowed for text study.

Production

Production of audio-vision programmes usually requires a variety of input from different individuals - academics, graphics artists, editors, sound technicians, producers and photographers (if pictures or slides are used). Since the material goes through several different stages of production - designing and editing the graphical and print material, recording the sound and handing over to contractors for printing and copying, thence packaging and mailing to students - it is necessary for the material to be produced some considerable time before the student is expected to use the material in his own home.

Due to the heavy reliance on accompanying print, audio-vision can run into serious production problems. The Director of Publishing reported that the late handover of broadcast notes constitutes a major editorial problem in many courses. Radio and television programmes are frequently made at a late stage in the overall production schedule of the course or, if a programme is not approved by the course team and is subject to alteration, it may not be finalised until a late stage. This, in turn, means that the broadcast notes cannot be prepared in sufficient time to allow for a satisfactory print schedule to be followed.

Many course teams prefer broadcast notes for a one-year print run only. If they are late, this one-year print run may well be in draft form. In the second year broadcast notes are then gathered together, corrected or updated as necessary, and bound together as one or more handbooks. Broadcast notes so handled will therefore be edited twice, in the first and second years of presentation, with double print and correction effort by editors and course team members. A small number of course teams consider it necessary for the students to receive the scripts of broadcasts, printed in full in supplementary handbooks.

Should audio-cassettes or records be sent out instead of broadcasts, it is possible that course teams would wish to prepare more elaborate programme notes. Unless cassettes and records were made at an early stage, the second year consolidation would still be necessary. To achieve consolidated handbooks in the first year, course teams would need to have programme notes for, say, the first eight units, ready in time for the first mailing, with this supplementary item being scheduled into the print production programme.

Copyright problems can also arise for non-broadcast audio-vision in the production of the audio component. There is a particular difficulty if a course decides to change from radio to cassette distribution during the life of the course. At present, no provision is made in the

standard contributor contracts for multiple copying of programmes for distribution to students. The existing contracts would need substantial amendment and this could only be done with the agreement of the contributors themselves and/or their professional representatives - i.e. Musicians' Union, Society of Authors, Equity, Publishers Association, etc. TD342 was the first course to use cassettes to replace existing broadcasts. None of the contracts issued to contributors covered this loan facility and letters seeking permission were sent to each contributor by the OU Copyrights Department. All the contributors were academics, civil servants or industrialists though and fortunately there were no dissenters.

In the past, relatively minor amendments to contributor contracts have taken several months to settle. Negotiations involve the University, the BBC, unions and professional bodies. This should be borne in mind and, in any case, agreement should be reached before cassettes are issued in lieu of broadcasts.

However, since the majority of contributors for cassettes or records are likely to be academic speakers, the introduction of cassette or record programmes should present few problems, provided that the OU Copyrights manager is given early enough warning. Where professional performers though - actors or musicians - are to be used, it may be necessary to make special contractual arrangements.

It is difficult to work out an exact overall cost for the production of audio-vision programmes since the actual amount and kind of visual material accompanying the audio recording can vary considerably - it may be restricted to simple line graphics in a booklet or it could require full colour print or slides (and consequently the supply of a slide projector). In addition the visual material may be incorporated in other material, for example, two or three pages in a correspondence unit or two pages in a media handbook (which may also be used to accompany radio and television programmes). Thus the costs of producing and distributing audio-vision programmes may be inextricably bound up with the cost of producing and distributing other course material (correspondence units, media handbooks, HEK's etc.).

Furthermore, while the audio component has up to now been accommodated in existing production capacity without additional direct costs, the accompanying visual components, particularly broadcast notes or audio-visual handbooks, have in the past led to production overload in parts of the University, and hence increased production costs. More recently, the Course Resources Committee has set an overall print limit of 55 x 32 "pages" per full credit, whatever form the print may take - correspondence text, supplementary material, or audio-visual handbooks. However, not all the accompanying visuals are necessarily in the form of print, and in any case accompanying print for audio-vision is likely to involve a high use of graphics, photographs, etc. If our earlier projection (p.28) of an output of something like 170 non-broadcast audio-vision programmes per year in addition to current radio production levels turns out to be correct, this could lead to heavy pressure on the Operations area.

Distribution: Audio-Vision, using Print

With such a wide variety of possible visual components, across so many courses, it is not feasible for us to provide a comprehensive costing of every possible variety of visual component. Furthermore, despite the full co-operation of almost everyone we approached, it was often impossible to obtain reliable and accurate costings of printed supplementary material, audio-visual handbooks, etc., for individual courses. Supplementary material in particular is one of

the few remaining areas of flexibility for a course team, after a course has been produced, for improving and updating a course, but this makes a strict method of accounting for such material difficult to operate, as some courses make greater and more frequent changes of material than others. We can, however, by selecting a few existing courses more or less at random, give some idea of the order of magnitude of costs for different accompanying visual material, although it is really impossible for us to say whether these courses have high, average, or low-cost supplements. The courses were chosen to indicate a variety of uses of audio-vision, across a variety of courses of different sizes.

One of the four courses we have chosen is A304 ("The Development of Instruments and Their Music"). This was first presented in 1974, to 428 finally registered students. As with nearly all courses, numbers have dropped each year, and over a six-year life, we estimate that the course will have approximately 1,500 students, or 250 per year, on average. This course has nine long-playing records, costing 64 pence each, (including packing, etc.) produced by the BBC. The visual component consists of musical scores to follow while listening, costing approximately 10 pence per student. In addition, the course has 16 television and 16 radio programmes.

The second course we have chosen is DT201 ("Urban Development"). This was first presented in 1973, to 937 finally registered students. Over a six-year life, we estimate a total course population of about 5,000 students, or about 850 students a year, on average. This course has 13 flexi-discs, (made by the BBC), 17 television programmes and 32 radio programmes. These audio-visual components are accompanied by four thick, printed audio-vision booklets, well-illustrated with diagrams, photographs, and colour. These booklets cost £0.59, £0.60, £0.40, and £1.38, respectively, or a total of £2.97 per student.

The third course chosen is SM351 ("Quantum Theory and Atomic Structure"). This was first presented in 1974 to 243 finally registered students. Over a six-year life, we estimate a total course size of 1,000 students, or an average of 167 a year. This course has six C60 cassettes, produced by Audio-Visual Services at Walton Hall. One of the cassettes is used in conjunction with a display sheet in a media booklet, costing approximately 23 pence per student. There are also 11 television programmes and 8 radio programmes. (Since this is a half-credit course, average costs and total costs should be doubled to give a full-credit equivalent.)

The fourth course is A305 ("History of Architecture and Design 1890-1939"). This was first presented in 1975 to 718 finally registered students, but this number dropped substantially to 323 in 1976. We have estimated a total course size of 2,000 students, or 333 on average per year. This course has 24 television programmes and 32 radio programmes, but no non-broadcast audio media. It does however have a printed, well-illustrated radio-vision booklet, costing £1.49 each, two printed broadcast supplements (BS), and a documents booklet. BS 1 cost £0.97 each the first year, but were revised and reprinted for the second and subsequent years, at a new cost of £0.87 each. BS 2 cost £0.49 each in the first year, and £1.54 each when revised and reprinted in the second year. The documents booklets cost £0.52 each. Over a six-year life of the course, and allowing for the sharp drop in course population after the first year, these four booklets average out at a cost of £4.07 per student.

We can now estimate the overall distribution costs of the audio-visual components for these four courses.

Table 28. Audio-Vision Distribution Costs for Four Courses

Course		A304	DT201	SM351	A305
No. of students estimated over 6 years		1500	5000	1000	2000
No. of students per year		250	850	167	333
Television.	No. of programmes	16	17	11	24
	Trans. costs for 6 years	£28992	£30804	£19932(x2=£39864)	£43488
Radio.	No. of programmes	16	32	8	32
	Trans. costs for 6 years	£6912	£13824	£3456(x2=£6912)	£13824
Non-broadcast audio component		9 LP records	13 Flexi-discs	6 cassettes	↑
Per unit per student (inc. postage & packing)		£0.64	£0.10	£0.42	None
Total distribution costs over 6 years		£8640	£6500	£2520(x2=£5040)	↓
Non-broadcast visual component		Musical Scores	A/V Booklets	Media Booklet	Booklets
Cost of visual material per student		£0.10	£2.97	£0.23	£4.07
Total distribution costs over 6 years		£150	£14850	£230(x2=£460)	£8140
Sum of non-broadcast A/V distribution costs over 6 years		£8790	£21350	£2750(x2=£5500)	£8140
Average non-broadcast A/V distribution per student		£5.86	£4.27	£2.75(x2=£5.50)	£4.07
Total audio-visual costs (excluding prod.) - 6 years		£44694	£59478	£26138(x2=£52276)	£65461
Average A/V cost per student - 6 years		£29.80	£11.90	£26.12(x2=£52.28)	£32.73

The non-broadcast audio-vision distribution costs are remarkably similar on a per-student basis, averaging between £4.00 and £6.00 (if SM351 costs are converted to a full-credit equivalence), though how much this is due to chance in our method of sampling is impossible to say. Total costs vary considerably, however, due to the large differences in course population. Thus DT201's total costs were £21,350, compared with SM351's £2,750 (or £5,500 for a full-credit equivalence). Furthermore, individual component costs can differ radically. Thus A305's print component of radio-vision was £8,000, and DT201's £15,000. Also, it must be remembered that Table 28 deals only with distribution costs. There is obviously a major production load involved in designing and producing such extensive and high-quality print components. There are also implications for student workloads - for instance, A305 was grossly overloaded in its first year of presentation.[1]

On the other hand, the non-broadcast audio-vision distribution costs must be examined in the context of the broadcast distribution costs. Broadcast distribution costs are fixed, irrespective of the size of the course. Non-broadcast audio-vision distribution costs vary with the size of the course. Thus the non-broadcast audio-vision costs for DT201 (a comparatively large course) were 36% of the total audio-visual distribution costs (including broadcasts), compared with 11% for SM351 (a small course). Generally, for small courses, it would seem that

1. MACE, E. Evaluation of A305, Internal IET Paper, 1976. 54

non-broadcast audio-vision distribution costs are likely to be less than 20% of the broadcast distribution costs, even when "expensive" materials are used. There is then a strong economic argument for putting resources into non-broadcast audio-vision packages, and reducing or in some cases even eliminating the broadcast component, for courses with small student populations.

Distribution: Audio-Vision, using Film-Strips or Slides

Full colour printing is expensive, and still only 54% of students have colour television sets. In many subject disciplines, however, there is a need for students to be able to examine colour material. Slides or film-strips, which are relatively inexpensive, ranging from 1p. to 8p. each, might seem to be one possible solution.

The problem with slides and film-strips is that they require a viewer. The problem could be tackled in three ways. One is to ask students to use or buy their own 35mm. slide viewer. From the Gallagher survey,[1] 47% of Open University students already own or have easy access to such a viewer. Suitable 35mm. slide-viewers can be bought at around £3 each. The University would provide the 35mm. slides, which cost approximately 8 pence each, and the students the viewers.

The second solution is for the University to provide students with a low-cost viewer, which uses film-strips, rather than slides. These viewers can range from 14 pence each for the "Focus" film-strip viewer, to 80 pence for a Master Stereoscopic viewer (see illustration overleaf). These viewers are made from cheap plastic, and are folded flat, for assembly by students, thus avoiding any mailing charges. These viewers use either half-frame or full-frame (35mm.) film-strips, i.e. a continuously joined set of 35mm. frames. For instance, a container of three full-colour film-strips, totalling 180 frames, can be supplied at a cost of £1.80 - or one penny a frame. The problem with low-cost viewers is that the picture image is not significantly magnified from 35mm. or 17.5mm. and requires natural light. Concentration for any period of time is difficult, as is the search for detail, which becomes important during a radio-vision programme. However, such viewers are adequate where there is not a need for an extensive use of such film during a course, as an evaluation of their use on S333 has shown.[2]

A third solution, where a course team is considering an extensive use of films or slides, would be to provide students with a good quality viewer. The ESL Bristol Prima Viewer, using half-frame film-strips, costs £23.50, plus £3 for replacement bulbs. The Halight 300 costs £48.50 each, but since it can also function as a projection microscope, a microfiche reader, and polarising projection microscope, it does offer a variety of functions which extend its uses well beyond those of a standard slide projector. However, in the cost examples below, we have used the ESL Prima Viewer, and assumed that the viewers would last six years, with two replacement bulbs being required per viewer, at a total cost of £6. We have assumed that the whole package would be returned at the end of the course by the student. If the package was despatched as a single item, mailing would come to a minimum of £1.25 each way, plus 50 pence for packaging, handling and checking. (In many cases, the package would be part of a home experiment kit, in which case the proportion of mailing and handling charges charged to the

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1. GALLAGHER, M. Broadcasting and the Open University Student, 1976, Milton Keynes, Open University, 1977.

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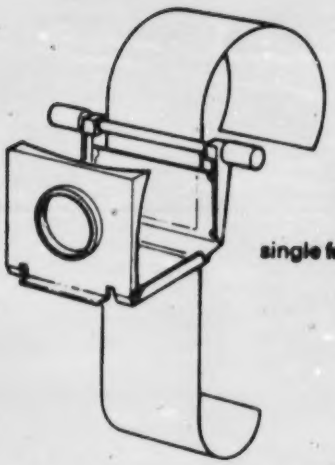
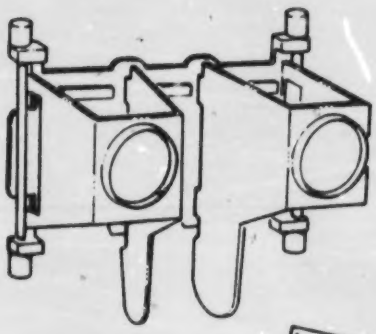
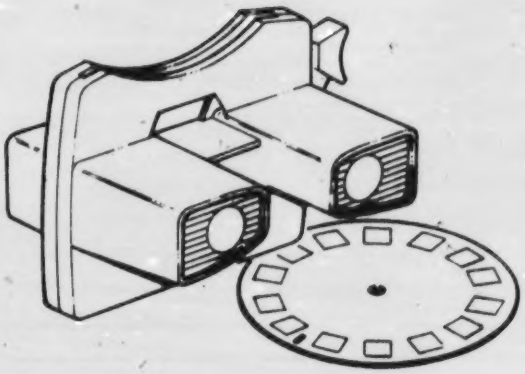
2. BERRIGAN, F. Broadcast Evaluation Report No. 25, Canadian Shield and Skye, S333, Radio 4, Milton Keynes, Open University, 1977.



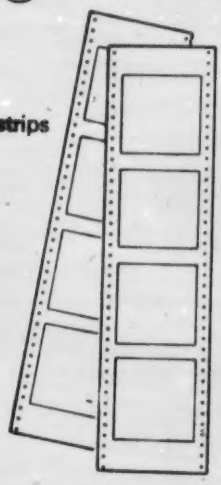
single frame viewer



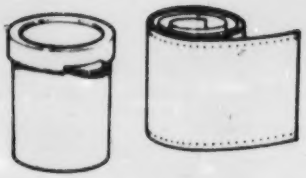
stereo viewer



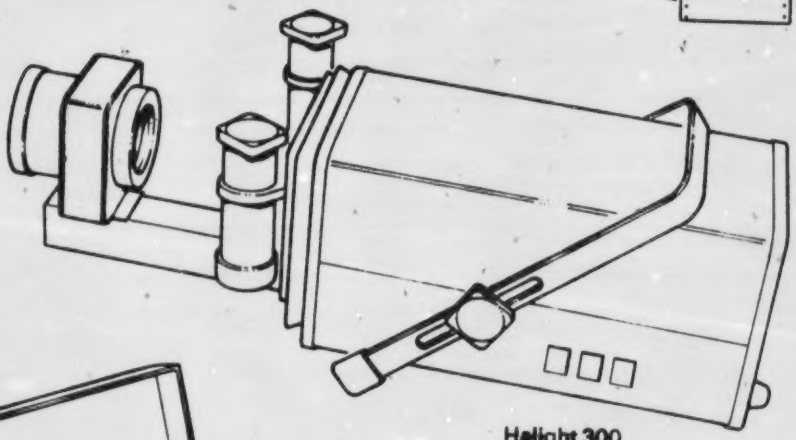
View Master



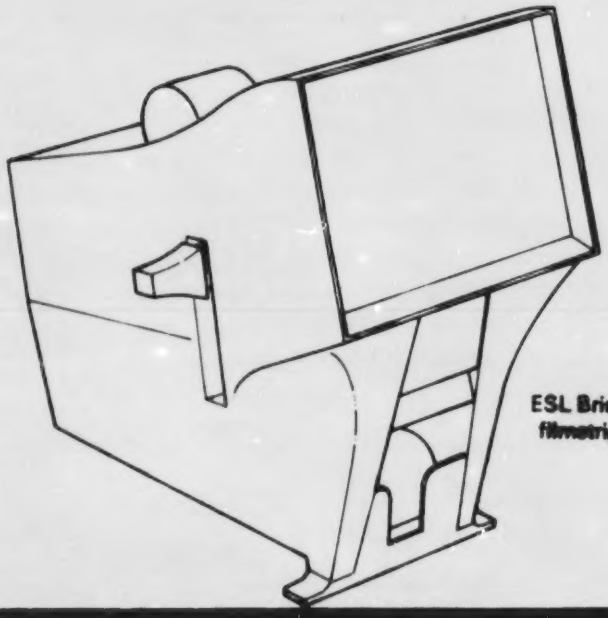
6in filmstrips



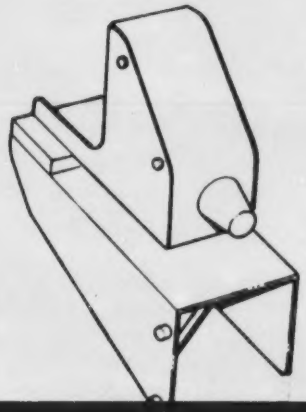
60-frame filmstrip
+
cannister



Helight 300
projection microscope
+
microfiche
reader



ESL Bristol Prima
filmstrip viewer



viewer would be somewhat less.) These assumptions provide an annual unit cost for each component as follows, for a course lasting six years.

180 slides = £1.80 ÷ 6 =	£0.30
ESL Prima Viewer + 2 bulbs = £29.50 ÷ 6	£4.92
3 x C60 cassettes = £0.33 x 3 ÷ 6	£0.16
Estimated mailing and handling = (£1.25 x 2) + £0.50	£3.00
Per student per year =	£8.38

We can now calculate costs. We have assumed the use of cassettes, and worked out costs per hour at the "real" time of playing a cassette, although we would expect students to spend considerably more time on the material. For comparative purposes, we have assumed 3 hours of cassette material and 180 slides or frames, although for low-cost viewers, we would not expect such a high use.

Table 29. Distribution Costs for 35mm. slides (assuming student ownership of viewers)

No. of students on a course	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Per hour per student	£5.55	£5.55	£5.55	£5.55	£5.55	£5.55	£5.55
3 x C60 cassettes per student (inc. post.)	£1.26	£1.26	£1.26	£1.26	£1.26	£1.26	£1.26
180 slides per student at 8p. each + £1 postage	£15.40	£15.40	£15.40	£15.40	£15.40	£15.40	£15.40
Total - over 6 years - for 3 hours + 180 slides	£9996	£19992	£29988	£49980	£99960	£199920	£299880
Average cost per student	£16.66	£16.66	£16.66	£16.66	£16.66	£16.66	£16.66

It can be seen then that the despatch of 35mm. slides is prohibitively expensive, even for small courses, and even when students have their own viewers. It should also be remembered that 180 slides would give an average of only 5-6 slides per unit in a 32 unit course.

Table 30. Distribution Costs for Low-Cost Viewers/Film-Strips

No. of students on a course	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Per hour per student	£1.29	£1.29	£1.29	£1.29	£1.29	£1.29	£1.29
3 x C60 cassettes per student (inc. post.)	£1.26	£1.26	£1.26	£1.26	£1.26	£1.26	£1.26
180 film-strip frames per student	£1.80	£1.80	£1.80	£1.80	£1.80	£1.80	£1.80
Master viewer (bi-lens) per student	£0.80	£0.80	£0.80	£0.80	£0.80	£0.80	£0.80
Total - over 6 years - for 3 hours + 180 frames	£2316	£4632	£6948	£11580	£23160	£46320	£69480
Average cost per student	£3.86	£3.86	£3.86	£3.86	£3.86	£3.86	£3.86

It can be seen that this is by no means an expensive method of distribution, and students would be able to retain both viewer and film-strips. Furthermore, the University has large stocks of low-cost viewers left over from existing courses, which could be used for new courses at virtually no extra cost.

Table 31. Distribution Costs for High-Cost Viewers/Film-Strips

No. of students on a course	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Per hour per student	£2.79	£2.79	£2.79	£2.79	£2.79	£2.79	£2.79
Per package	£8.38	£8.38	£8.38	£8.38	£8.38	£8.38	£8.38
Total - over 6 years - for 3 hours + 180 frames	£5028	£10056	£15084	£25140	£50280	£100560	£150840
Average cost per student	£8.38	£8.38	£8.38	£8.38	£8.38	£8.38	£8.38

Surprisingly, this works out to be less expensive than sending students 35mm. mounted slides, and using their own viewers, although of course it is more expensive than using a retainable, low-cost viewer. For courses with relatively low student numbers, however, with a heavy demand for the use of good quality colour pictures, this system may well have advantages, and would not be outrageously expensive, especially since the amount of film-strip frames could be considerably increased from 180 at very little extra cost.

Comparative Distribution Costs of Audio-Vision

Making comparisons on costs for audio-vision is very difficult. The mix required by a course will depend very much on its educational needs - music courses requiring a lot of audio material, geography courses requiring colour maps and photographs, art and architecture courses requiring colour prints, slides, or diagrams, maths courses requiring sound, and diagrams, formulae, etc. Furthermore, the amount of time spent by students - and hence to some extent the quantity of audio-vision material provided - will vary considerably from course to course. For one course, a dozen or so colour slides might be all that is required, but nevertheless invaluable. Another course may require a great deal more illustrative material. Also, the situation is affected by whether audio-vision is used as a supplement to and integrated with the radio and television components, or whether it is used instead of radio and/or television.

Nevertheless, it is useful to have some comparative costs, if only to indicate their order of magnitude. In what follows therefore we have given costs for a full-credit course or its equivalent (i.e. doubling relevant costs for half-courses). Wherever possible we have used "real" courses, although this does mean that there may be some variation due to inflation which has not been fully allowed for. Furthermore, it is particularly important when the University is proliferating a very large number of courses with comparatively low student numbers that average costs per student are examined, rather than total costs per course. It is for instance a dangerous argument to claim that one could use certain costly media only on small courses, since such costs rapidly escalate when there are many such courses. For instance, a cost of £20,000 for distributing the audio-vision component of a course may not seem much, but if there are only 200 students on such a course each year the average cost per student is £16.66 (over six years). If such an amount was spent on all students throughout the University, the cost just for distributing the audio-vision components alone would be £1 million. Thus we give average costs per student, and the total in the unlikely case of distributing each audio-vision mix to all students, assuming a student population of 60,000. The average cost per student for A305 is calculated in three ways. One includes the transmission costs for sixteen radio programmes. (The course was in fact allocated 32.) However, the course population is low (about 333 a year, on average). We have therefore calculated a cost if radio transmission for 16 of the 32

programmes was replaced by 6 cassettes (C60). Finally, we have calculated distribution costs with an audio contribution, for those who would consider that audio-vision should be seen as an addition to, not as a replacement for, radio.

Table 32. Average Distribution Costs Per Student for Different Kinds of Audio-Vision

		Average cost per student	Total if spent on 60,000 students
A304:	9 LP records plus musical scores	£5.86	£351,600
DT201:	13 Flexi-discs plus 4 A/V Hand-Books	£4.27	£256,200
SM351:	6(12) Cassettes + 1 Media Booklets	£5.27	£316,200
A305:	Radio-vision (16 radio + 4 Media Handbooks)	£7.53	£334,056
A305:	Radio-vision (6 cassettes + 4 Media Handbooks)	£6.59	£395,400
A305:	(4 Media Handbooks, excluding audio)	£4.07	£244,200
35mm. slides plus 3 cassettes:		£16.66	£1,000,000
Low-cost viewer/film-strip + 3 cassettes		£3.86	£231,600
High cost viewer/film-strips + 3 cassettes		£8.38	£502,800
Radio transmission costs		£1.50	£89,856
Television transmission costs		£6.85	£410,720

Conclusions

It seems to us therefore that audio-vision has three different, valuable roles to play for the University. Audio-vision is a powerful teaching medium in its own right, particularly where there is the need for the teaching of certain skills, especially in maths., science and technology, which require practice for mastery. In the form of radio-vision it could strengthen the role of radio on courses with large student numbers. Finally, audio-vision could ease the transmission problem for radio, by using non-broadcast audio-vision as a replacement, partial or total, for radio on some courses with low student numbers.

Generally, audio-vision distribution costs need not add too greatly to the University's overall bill. The additional distribution costs, even if there was an extensive use of audio-vision across all courses, should not greatly exceed £250,000 in a steady state, and it will be a number of years before such a level of expenditure is likely to be reached.

There could though be more serious problems in the production area, particularly regarding the demands likely to be placed on Editing and Media, by the future growth of audio-vision. There are also implications for student workload, when courses include four thick audio-visual handbooks in addition to the correspondence material and set books. We know of at least one instance in the past where the broadcast notes for one television programme were twice the length of the accompanying, average-length correspondence text. We are not arguing that such developments are necessarily unjustified or even avoidable, but course teams and the Course Resources Committee need to be aware particularly of the print production implications, when course teams ask for audio-vision resources. Even given the new procedures of Course Resources Committee, which has recently tightened up considerably on the allocation of resources for supplementary material, the growth of demand for audio-vision is likely to stretch existing resources in the Operations area.

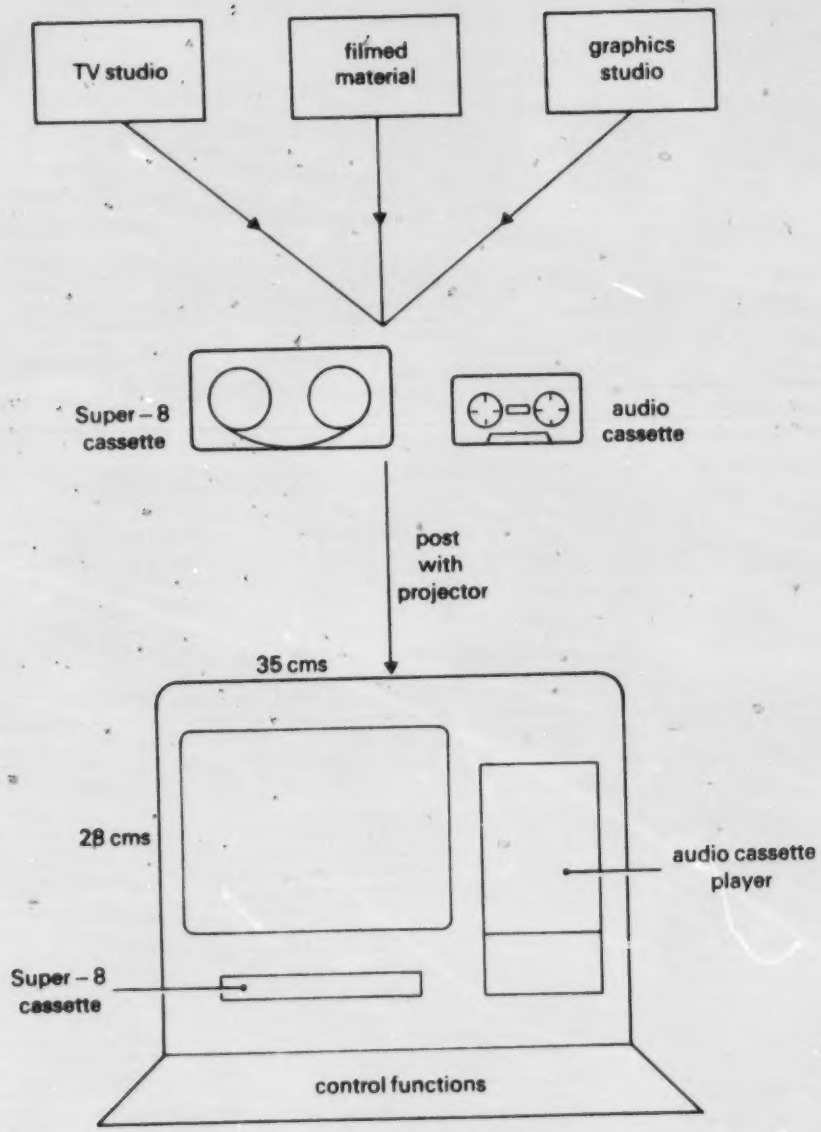
MIXED-MODE SUPER-8MM. CASSETTE PROJECTOR

A super-8mm. film projector, with synchronized sound (obtained from a standard audio-cassette player), is being developed by King's College, London, and Colour Cassettes Ltd.(see over) The projector and audio-cassette player are housed in a single unit about the size of a portable television set (28 x 24 x 25cms.). The display screen is 15 x 20cms. To operate this equipment the student would be required to place the super 8 cassette in the projector and the synchronized audio-cassette tape in the player. A standard 100 foot super 8 cassette would contain 5,000 still colour frames or 4 minutes of moving film. The audio-cassette could be a C30, C60 etc. Depending on the style of presentation the film cassette could provide a mixture of still pictures, printed text and moving film with synchronized sound. Thus programmes could be developed for varying lengths of presentation. Since the student has control over the equipment (he can stop the presentation, move forwards or backwards etc.) the student can determine his own pace for working through the material. With the addition of an automatic random access facility the student can locate any particular frame or moving sequence. The equipment is not inter-active, in the sense that the student cannot communicate with tutors/course designers via the equipment, though it would be possible to design the programme material in a programmed learning fashion, whereby the student stops the presentation when asked to respond to a question, then restarts the programme to verify his answer.

The designers claim that the picture image on the final prototype will be sufficiently sharp for the equivalent of a page of print to be easily read from the screen. With 5,000 frames, a super 8 cassette would be able to provide three minutes of full moving pictures, plus the equivalent of 1,440 pages of full-colour A4 "printed" pages (or the equivalent of roughly 25-30 correspondence texts). The designers also claim that many of our television programmes could be reduced to the equivalent of three minutes motion picture, with the remainder of the programme reduced to single frames. For instance, they have managed to put the whole of A201, TV4 ("The Building of Florence Cathedral") on to a 100 foot super 8 cassette, which provides no more than four minutes of continuous motion picture. Theoretically, then, it might be possible to condense all 32 correspondence texts and the equivalent of 16 television programmes into something like 20-25 super-8mm. cassettes (100 feet), for some courses. Of course, given such a medium, moving pictures and simple animation would be broken up and integrated with the textual material itself, so that motion and animated diagrams would be placed next to the relevant reading matter. In other words, the production mode would be quite different from television.

The production of software material for the mixed mode programmes would require input from graphics artists, sound technician, television/film producer and academic. As the material to be transferred to Super 8 film would come from a variety of sources, (print, graphics, still photos and 16mm. film), it would have to be prepared some considerable time before it is sent to students (either separately through the mail or with the projector before the academic year begins).

As the mixed mode projector is in its early stages of development it is difficult to estimate the actual costs involved in producing and distributing the hardware and software. However, for a development run of 150 machines the cost of the basic projector and audio-



Mixed Mode Super – 8 Film Projector with Synchronized Sound

cassette player would be £250. If the automatic random access facility was included this would add £150 to the price. The cost of a 100 foot super 8 cassette would be £3, and the cost of a C60 cassette 33 pence. In addition, there would be a substantial packing and mailing cost. The machine is bulky, and based on the costs for the A241 home experiment kit (which it approximates in size), packing and transportation costs to students homes would be as follows:

Cost of outer box	£3.00
Cost of inner box	£0.90
Cost of special inner packing	£1.70
Warehouse packing and labour costs	£0.83
Stores and mailing handling costs	£0.83
Clerical costs	£0.28
Transit costs	£4.50
Cost per instrument despatched	£12.04

These costs are estimated rather on the high side, and would no doubt be reduced for bulk operations, but given that return costs and insurance need to be added, a figure of approximately £12 is probably about right. Thus we get unit costs as follows, assuming a six-year life:

25 super-8mm. cassettes @ £3 each ÷ 6 =	£12.50
Combined projector and random access audio-cassette projector = £400 ÷ 6 =	£66.67
25 x C60 cassettes @ 33 pence each ÷ 6 =	£1.37
Packing and handling	£12.04
Per student per year	£92.58

The problem is what to set this off against. There would probably be no need for radio, nor for correspondence texts in the form that we know them, although no doubt some print would be necessary. Possibly there would also be a reduced need for television. At a very rough guess, production and design costs are likely to be similar to those for conventional course production. If we therefore allowed roughly £32 per student for savings on print distribution, (i.e. £1 per unit) and the savings on transmission costs for 8 television and 16 radio programmes, we might get somewhere near a comparative cost figure, as shown in Table 33.

Table 33. Distribution Costs for Mixed-Mode Super-8mm. Cassette Systems

No. of students on a course	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Cost per student per full credit	£93	£93	£93	£93	£93	£93	£93
Savings: print (£32 per student)	£32	£32	£32	£32	£32	£32	£32
8 television trans. (per student)	£12.08	£6.04	£4.02	£2.42	£1.21	£0.60	£0.40
16 radio trans. (per student)	£11.50	£5.76	£3.84	£2.30	£1.15	£0.58	£0.38
Average cost per student after savings	£37	£49	£53	£56	£59	£60	£60
Total cost - over 6 years - after savings	£22200	£58800	£95400	£168000	£354000	£720000	£1,080,000

We are not at all happy about our method of costing this development, but it does seem that even allowing for savings to some extent on print and television and radio transmissions, such a system would not be economically viable.

The Kings College/Colour Cassette concern have yet to produce a fully working prototype. It will then be necessary to find a manufacturer willing to move it to the production model stage. In addition the production of software material which would be appropriate to the mixed-mode programming envisaged would require considerable developmental testing before an established format could be evolved. However, the only way to test such a system properly would be to pilot it on a small course, with 100-150 students. Such a pilot exercise would cost about £60,000 over the normal costs of putting on a course, assuming that the courses would run for six years.

We would not wish to rule out altogether at this stage the potential of such a system for the Open University, but unless a course team is particularly eager to experiment with such a system, and unless the unit costs are considerably reduced, we cannot recommend a pilot exercise at this stage of its development.

ELECTRONIC TECHNOLOGY

Recent developments in electronics bring with them tremendous potential for low-cost, home-based teaching systems. In most cases, these developments build on and exploit already existing domestic equipment, such as the telephone, the television set, and the cassette recorder. By using common domestic equipment, and low-cost micro-processing techniques, hardware costs are dramatically reduced. The main problem with these new developments is a common one in education - not the technology itself, which already exists (although it is still being dramatically improved and developed), but how to use it and build it into an already established teaching system.

Telephone Teaching

The introduction of more modern exchange equipment, the desire of the Post Office to maximise the use of underused lines at off-peak times, and the increasing difficulty of arranging class tutorials for courses with low student numbers, have all combined to promote telephone teaching at the Open University.

Telephone teaching is a way of providing tutorial assistance and feedback to students who are distributed throughout a region. The telephone connection can be made between a tutor and one student or it can connect one person (the tutor) to several students. In this latter mode all participants are at their home telephone (or a convenient one nearby). The participants (up to seven students plus the tutor) are linked up by the Post Office at a designated time. Thus the students and the tutor can have, by this conference call technique, a standard "tutorial session". Two-way communication is possible from the tutor to his students and from one student to the others as any of the participants can come in to ask or respond to questions or statements.

As well as allowing students to interact both with their tutor, and with their fellow students - as in a classroom tutorial - telephone teaching saves time, effort and money. There is very little work required by the student or the tutor in arranging a conference call session except to arrange to be at the end of the telephone at the designated time; the actual connections are made by the Post Office. Unfortunately the line quality is often poor and setting up by the operator sometimes causes irritation due to delays.

The Post Office however is giving greater priority to improving conferencing facilities, and even with existing arrangements, the method does appear to work, and is being used substantially in a number of the Open University's regions.

Moreover as course populations continue to decline and some regions have very few students taking any particular course it will be very difficult to arrange adequate face-to-face provision. Thus the telephone conferencing technique may be the only way in which regular tutor-to-student and student-to-student contact can be maintained.

Experience in the use of the telephone for teaching, tutorials, feedback etc. is developing rapidly as more courses with low student numbers (overall or in particular regions) are being added to the total course profile. Since these developments are being researched both within the Open University by Ken Giles and Bernadette Robinson (in the East Midlands Region), and from

outside, by Sandy Hammond, of the Communications Research Group, University College, London, we will restrict our comments on telephone teaching itself to the cost aspects, other than to point out that some of the other electronic developments we shall be looking at will depend on or be considerably advanced by an efficient and flexible telephone system.

The cost of telephone conferencing varies according to the geographical distribution of the participants. In London the cost would be £3 per hour. In regions which are more geographically distant £10 per hour would be the norm. (These costs are presently being borne by the University.) In addition there is the cost of the regional tutor time which in 1977 is £6 per hour. Thus the average cost of providing students with a "tutorial session" via telephone conferencing, per student, per hour of time is:

Average cost one hour conference call to seven students	£10.00
Cost of regional tutor time	6.00
	£16.00
Cost per student per hour (£16.00 ÷ 7) =	£2.28

(We have deliberately taken the £10 rather than £3 figure, as this is likely to be the figure for the areas in greatest need of telephone teaching.)

Tutorial provision though varies enormously from course to course. So too does the use students make of face-to-face group tutorials, even when provided on a regular basis at foundation level. However, since in a recent survey[1] it was discovered that 88% of Open University students have easy access to a telephone for study purposes, we have to assume that the potential for telephone teaching is at least as great as for face-to-face tuition. Again, for comparative purposes, we have assumed the equivalent of eight hours per full credit telephone tuition time. This provides the basis for Table 34.

Table 34. Maximum Teleconferencing Tutorial Costs (8 hours Per Credit)

No. of students on a course	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	← 4% →	
Per hour per student	£2.28	£2.28	£2.28	£2.28	£2.28	£2.28	£2.28
Total - over 6 years - for 8 hours per year	£10944	£21888	£32832	£54720	£109440	£218880	£328320
Average cost per student - 8 hours	£18.24	£18.24	£18.24	£18.24	£18.24	£18.24	£18.24
Total - over 6 years - at 50% take-up	£5472	£10944	£16416	£27360	£54720	£109440	£164160

Unfortunately, we are unable to compare these costs with the costs of face-to-face class tutorials. We hope however that this might be taken up by one of the other studies. In particular, it would be valuable to know at what course size it becomes more economical to provide telephone teaching, given the different usage of class tutorials and telephone conferencing. Even if only 50% of students on a course however made use of a teleconferencing facility, the costs would be quite high, for courses with more than 500 students. Using the same basis for costing as in Table 32, we obtain the following figures:

1. GALLAGHER, M. Broadcasting and the Open University Student, 1976, Milton Keynes, Open University, 1977.

Table 35. Average Cost Per Student for Teleconferencing Tutorials (8 Hours Per Credit)

Take-up of Teleconferencing Facility	Average Cost Per Student	Total if Made Available to 60,000 students
All students with access (88%)	£18.24	£963,072
Half students in University	£18.24	£547,200
One-third students in University	£18.24	£364,800

It is of course extremely unlikely that all students would be offered teleconferencing facilities rather than face-to-face tuition but this table does show that teleconferencing tutorials are comparatively expensive, compared with some of the other audio-visual media we have examined, although, because they would be part of the general regional telephone costs, this would not be so immediately apparent, unless separately accounted for in the regional budget. In any case, cost comparisons should be made not with other audio-visual media, but with the cost of the more conventional class tuition provided in the regions.

Viewdata, Ceefax and Oracle (Teletext)

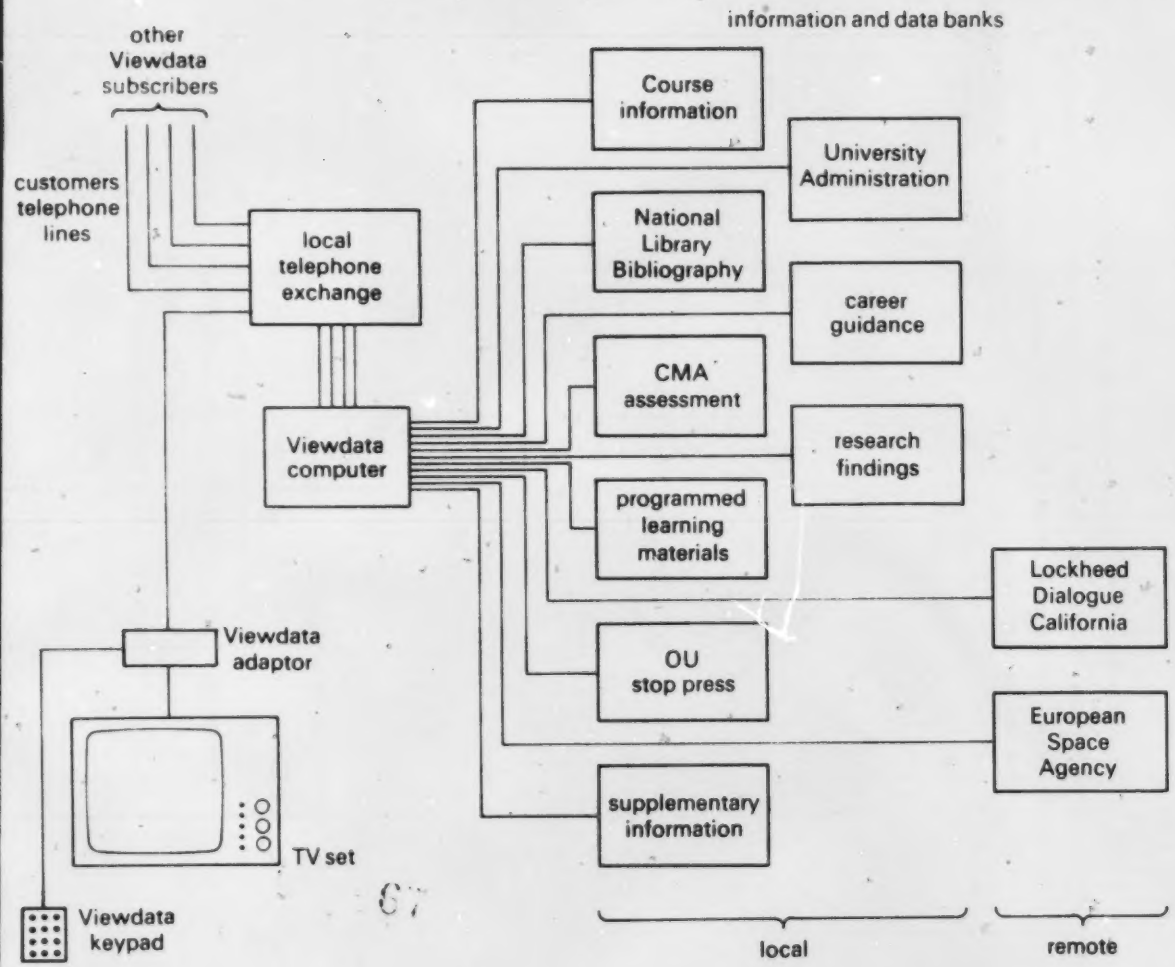
Viewdata is a data (information) access, visual display service which has been developed by the Post Office. The Viewdata receiver is a modified TV set, capable of receiving normal TV programmes, Ceefax (BBC) and Oracle (IBA) broadcast information services, and Viewdata as well. The modification to the domestic TV set allows the set to display text and graphical information transmitted via the public telephone network. The user's telephone extension is connected to the set by Post Office Engineers. (see illustration overleaf)

A small keyboard is used to select a required page (960 characters per page) of information. By pressing a single push-button, one of ten display choices may be selected, a second operation selects one of ten subsets and so on. Thus six push-button operations, taking less than half a minute, enables one of a million pages of information to be selected. The user can be guided through the material on the displayed pages. He can search backwards or forwards through the sequence of pages by means of the simple keyboard. By adding an alpha-numeric keyboard it becomes possible to use Viewdata to provide a fully automatic message service, messages being stored at the exchange until the recipient is ready to receive, and then displayed on the television receiver screen.

The information available for display on Viewdata can be changed by the information providers as frequently and as rapidly as is necessary. Additional data banks can be added as demanded (perhaps paying a special user fee to the source).

Since the user can generate his own information for retrieval, it would be possible for the Open University, for example, to provide students with a direct literature retrieval, CMA-type examination, programmed learning and computing service. Production of this software material would thus require input from academic course team members, library staff and the student computing service. The materials could be produced instantaneously as an academic types out information on the alpha-numeric keyboard for simultaneous use by students, or the material (i.e. programmed learning) could be produced (and perhaps developmentally tested) a few weeks prior to the intended use by students.

Ceefax has been developed by the BBC and Oracle by the IBA. The general term Teletext is now used to describe these two systems. Basically textual information is transmitted in the



Viewdata schematic

spare capacity available in the broadcast television waveform. This information is then reconstructed in the same manner as Viewdata with 960 characters per page and in seven colours. However, unlike Viewdata, which is inter-active and has theoretically an unlimited information capacity, Teletext is not inter-active and has a limited capacity of 800 pages of text. In addition the information available on Teletext is determined by the supplier (the BBC or IBA). At the moment Teletext data-information is being used for up-to-the-minute news reports, weather information, stock market reports and consumer information (food prices, entertainment guides, etc.).

At this early stage of development of Viewdata, costs of the eventual service cannot be stated with any accuracy. At the moment the cost of the modified colour TV receiver is approximately £1,000. However, this is expected to decrease to £500 in three years time and to perhaps £300 in 5 years time. In the near future it is anticipated that manufacturers will add the necessary modification to their production sets which may add only £50 to the cost of a standard colour TV set. In addition to the cost of a modified TV receiver the user will have to pay the cost of the installation charge for a telephone extension, call charges (probably on a local call basis), and a usage fee for Viewdata (on a per page basis). To the information provider the cost will be made up of a charge for display. (An income will also be available, however, based on the number of users who consulted the provider's material.)

The manpower cost of producing software material for use by Open University students would be similar to the costs of academics writing units, and library and student computing service staff performing their present duties. The number of man-days required to produce programmed learning materials would depend on their complexity and length. A small amount of graphical design would be required but it would be unlikely that a specialist Viewdata producer would be required after academic and library staff gain familiarity with its use.

Currently the Open University has the equipment on loan for one year. The Faculty of Technology and other groups around the University are experimenting with Viewdata to determine the types of information which would be suitable for storage and retrieval by students and regional staff. The future use by the University depends, to a large extent, on the flow of ideas about possible applications and on their evaluation.

The Post Office plan to offer Viewdata as a full public service in 1980. By that time the Post Office should have an established user cost per unit of time and most probably relatively low-cost adaptors for using Viewdata will be available on new colour sets. Even now, one can rent Viewdata-adapted sets from normal High Street rental companies, although at the moment prices are high. By the end of the 1980's, though, most British homes are likely to have television sets with Viewdata/Ceefax/Oracle facilities as standard equipment.

It can be seen therefore that the potential for this machine lies in it being a standard piece of equipment in most students' homes, in the same way as current domestic television sets. This is not likely to occur however within the next five years, and the University can only wait on the commercial development of this equipment, before it can be widely used in course design.

Nevertheless, its educational potential is enormous. If the University made available its student computing service programs, for instance, for access through Viewdata, every student would have his own domestic computer terminal and visual display unit, at no extra cost for equipment. Supplementary material, in the form of latest research results or articles, up-dated information, revised and corrected teaching materials, CMA answers and feedback, could all be made immediately available to students to call up when they wanted. Most important of all, Viewdata could provide an inter-active, computer-aided instruction facility in every students' home, if the University provided the programming.

Although it will be a number of years before the Viewdata facility is available in most of our students' homes, there are several steps the University should be taking to prepare for its introduction:

(a) pressure should be put immediately on British manufacturers to include the Viewdata facility as a standard piece of equipment in television sets. A letter from the Vice-Chancellor to the Chairman of BREMA and the Post Office would be most helpful, in this respect. However, the University should indicate the technical features which they believe would make the system of most value to the University, since the Post Office's current proposals do not give the system as much scope as is now believed to be technically feasible, and desirable for Open University teaching purposes.

(b) students should be informed of the potential of Viewdata, and the likelihood of its future use by the Open University, although they should not be advised to obtain sets with a Viewdata facility until the Post Office offers it as a full public service.

(c) because of the timescale of Open University production, the first course with Viewdata built in as part of the course design could not be presented before 1980. It is however vital in our opinion that the University should seriously evaluate the potential and limitations of Viewdata on a "real" course. We recommend therefore that the University should seek as soon as possible a course team that would be willing to make an extensive commitment to the use of Viewdata in its course design (from the beginning). The course would need to have about 300 students initially, and its subject matter should lend itself to computer-assisted instruction. The University should negotiate with the Post Office and a manufacturer to make available, at a special rate, 300 Viewdata adaptors, which could be used with existing domestic TV sets. There should be a thorough evaluation both during the design of the course, and during its first year of presentation. We recommend that the University should seek to enter into a joint research project with the Post Office for this development. The full cost of such a research project (including equipment) would be £100,000, but if the Post Office were to loan Viewdata adaptors to the University for the experiment, this would reduce expenditure considerably. In any case, research expenditure for this project should be shared between the Post Office and the University.

(d) Student Computing Service and Data Processing should begin investigating the compatibility of their programming and data transmission systems with those required for Viewdata.

(e) equipment being developed in the University relying on display on domestic television sets should be compatible with the Viewdata decoder - i.e. it should be able to make use of the Viewdata decoding and display system.

Electronic Blackboard

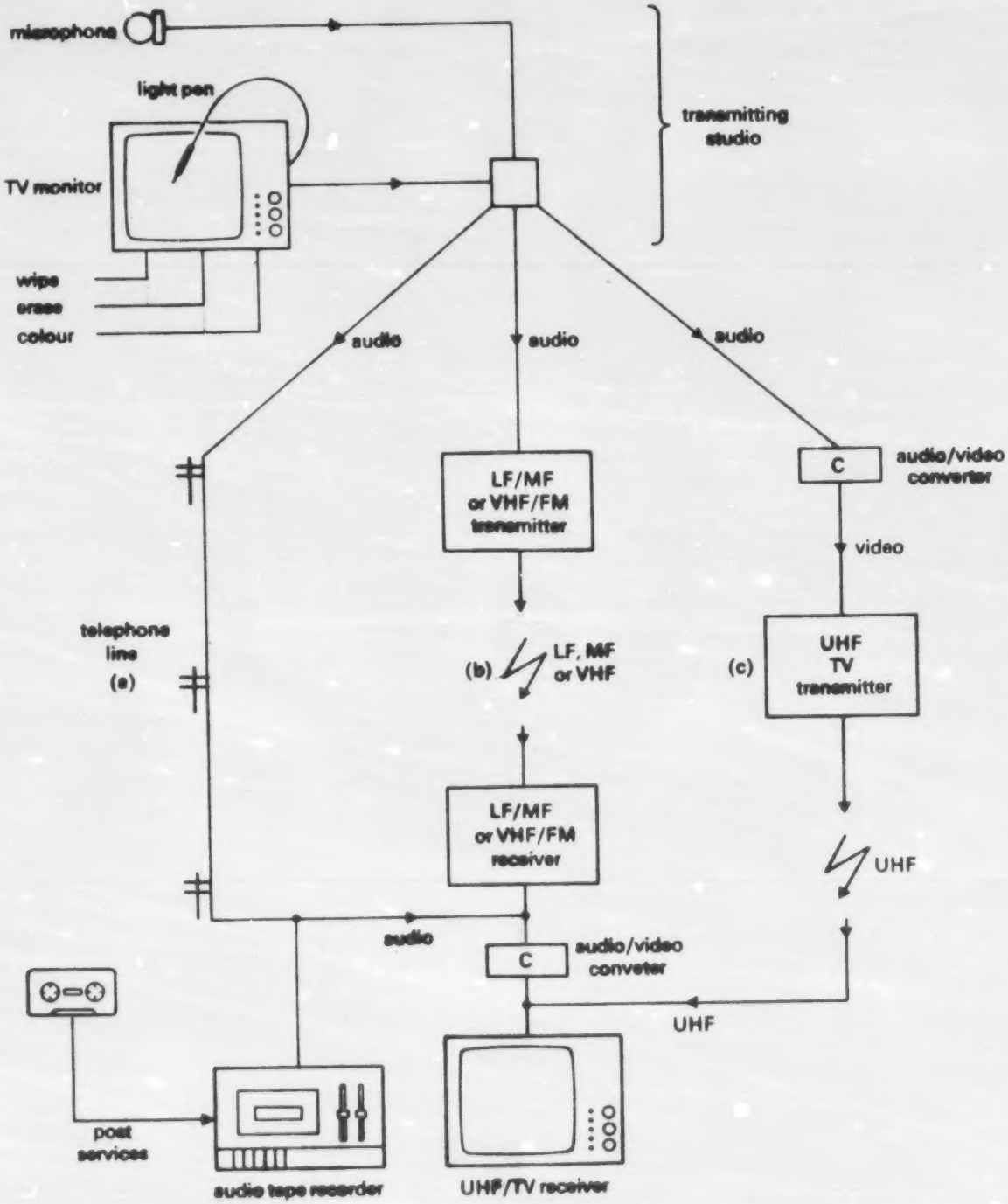
Electronic Blackboard enables handwriting, sketches and simple diagrams to be displayed on a standard television receiver; this information may be transmitted via telephone lines, broadcast transmitters, or audio tape, and converted by an audio/video converter, for display on the television screen. Display can be in colour (if used on a colour monitor) and can, as the graphics are progressively constructed on the screen, provide simple animation.(see illustration)

The Philips Company of Holland have produced 10 prototype machines and are planning to produce production modules when the technology (integrated circuit memory devices) permits a higher quality of resolution and full graphical display. If the material is transmitted on an audio-cassette, or if an audio recording is made of the material as it is transmitted down the telephone line or recorded from broadcast transmitters, then the student can replay the material when he wishes; he can move forwards or backwards to search the material and he can stop the programme as he wishes (or when responses to questions are required). If the source of the material is a tutor using a writing tablet, (containing two mutually orthogonal printed fine-wire gratings, capacitively coupled to a ballpoint pen, and transmitted live down the telephone) then it would be possible for the tutor to illustrate an argument to his remote students (as they view the material on their home TV sets). Also, if the student had his own writing tablet it would be possible for the student to respond immediately to questions and to receive feedback on his answer. Programmes could be generated either nationally, by a central academic, or locally, via a regional tutor.

If the tutor is using Electronic Blackboard with the writing pad through the telephone system or via broadcast transmission, then programme production is more or less instantaneous. On the other hand if the material is to be transmitted via a home delivered audio-cassette then programme production will need to be undertaken some considerable time before transmission. If computer graphics are required, prior preparation is necessary, even for telephone or broadcast transmission.

This invention is still in its early stages of development. Prototype equipment has been built and trialled by the Technical University, Delft (Netherlands), the Technical University, Bandung (Indonesia) and the Technology Faculty of the Open University (by Chris Pinches and David Liddell). The Bell Telephone Laboratories in the U.S.A. have also developed a "remote blackboard" system for operation over telephone lines. Field trials on this system are being carried out at the University of Illinois with special attention to the human factors involved. There are still some technical difficulties to be overcome, but these are by no means insuperable.

However, to date no manufacturer has come forward with a production model, which is understandable - there is no guaranteed market. Until however there is a large production run, unit costs will be sufficiently high to deter potential buyers, including the University.



Electronic Blackboard System

The production of programme material for Electronic Blackboard will most certainly require some considerable development in technique. At the moment specialist computer graphics advice is required though it may be possible to by-pass complex computer graphics by using a digital facsimile device which will encode information direct from a standard A4 page.

The cost of the hardware equipment is difficult to estimate since the prototypes produced have not been fully production engineered. According to Chris Pinches the approximate cost of the equipment (for a production run of at least 100 machines) would be £300. This price may decrease substantially as the price of random access memory devices and micro-processors decrease (as is occurring at the moment). To this cost we must add the cost of telephone transmission time (and hook up charges) if live telephone transmission is used; the costs of broadcast transmission (VHF TV transmission or LF/MF/VHF and FM radio) if this form of transmission is used; or the cost of stereo-cassette distribution if the audio-cassette version is used. In addition there would be the manpower costs involved in software production of programme material: academic time, graphic artist, sound technician/producer and computer graphics designer.

An approximation of these costs is provided below:

	Audio-video converter	£300 each
	On-line telephone link - seven students	£1.43 per hour per student
OR	Broadcast transmission (per hour)	£108. (for all students)
OR	C60 stereo cassette (per hour)	£0.60 per student

In addition, there would be mailing and packing charges.

Electronic Blackboard has strong educational potential, especially for the teaching of mathematics, economics, and engineering subjects. The main problem lies in its current costs. We are sure that should a manufacturer such as Philips decide to go into the market and produce audio-video converters in quantity, their costs would come tumbling down. Even so, the University would still have substantial costs to bear for distribution, mailing and packing charges, although these are unlikely to exceed those currently incurred for most home experiment kits. Until a manufacturer is willing to take on the production of sizeable quantities, we cannot recommend the University to invest in this development for course production. We do however believe it is valuable for the University to continue to monitor commercial developments in this field, and in particular to seek ways of simplifying the design of graphic materials, and the development of appropriate teaching material for such a system, for even if Electronic Blackboard fails to develop, the production of such "software" would still be appropriate for other systems. Such material might be "trialled" at Summer Schools.

Finally, we suggest that if the Technology Faculty continues its development work on Electronic Blackboard, it should ensure that its decoder and display system is compatible with those for Viewdata, Ceefax and Oracle.

Digital Audio-Vision and Television "Games"

Digital audio-vision has been developed by Paul Bacsich and Graham Read from the Mathematics Faculty at the Open University. It is similar to the audio-cassette version of Electronic Blackboard. (In fact the Technology Faculty has joined with the Mathematics Faculty

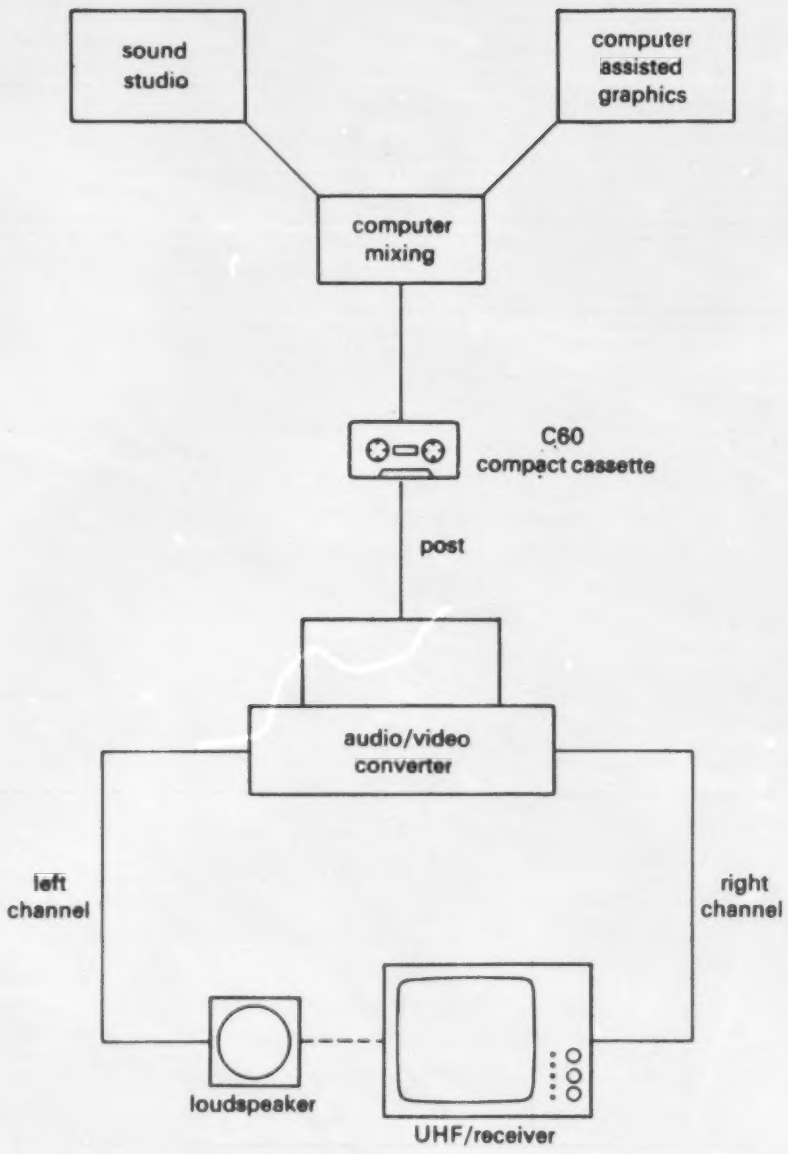
in developing this project.) Basically still vision and synchronized sound material is transferred on to a standard stereo audio-cassette: the right channel holds tones encoding digital information and the left channel is an ordinary sound track. The stereo cassette is then played on a stereo cassette player through an audio/video converter which demodulates and records the graphic information and stores it in an integrated circuit memory; in the final stages of the converter a standard 625-line video colour signal is built up from the speech and graphic signals and translated to a suitable VHF channel for display on a standard monochrome or colour TV receiver. A new full screen diagram can be shown every 10 seconds if necessary, and parts of diagrams changed much more rapidly, so that a limited form of animation is possible.(see illustration overleaf)

A standard C60 stereo cassette will hold one hour's playing time of sound and up to 360 full-screen frames (many more partial ones). Since the material is on cassette the student user has the freedom to pause, skip forward, rewind and, of course,to use the material when it is convenient. It would also be possible to transmit the material live via radio or over the telephone line either for immediate use or for storage (and use at a later time). Unlike the Electronic Blackboard with the writing pad facility, it is not possible for the student to respond directly to questions put to him by a tutor, though it would be possible to respond by stopping the tape, answering the question, then restarting the tape to verify his answer.

Similar to Electronic Blackboard, productions of software material would require the combined talents of an academic, sound technician/producer, graphics designer and computer graphics designer. As mentioned earlier it may soon be possible to by-pass the computer graphics by using a digital facsimile device which will encode information direct from a standard A4 page. Once this is made possible then the production time can be shortened and it may be possible to send students cassettes which are made a few weeks before mailing (thus making feedback and remedial teaching possible).

A related development can be seen in pubs and toyshops, in the form of television games. The designers of these games are now also beginning to use audio-cassettes for the storing of "programmes". The advantage of the television game system is that the processor (the audio-video converter) costs only around £20 (cheaper than a stereo cassette player). A British company - General Instrument Microelectronics Ltd. - is interested in diversifying from games into the educational market, with the possibility of developing not only educational "programmes" instead of games, but using the same hardware and technology, but also an inter-active system, allowing students to manipulate or alter the input themselves. For instance, in such a system, students could enter different values for a function in mathematics, and observe the effect of such changes on a graph projected on to their own domestic television set.

We envisage such a system working as follows. Students would be sent a "control panel" (actually a processor) which can take and convert into a video signal an output from an audio-cassette. The student would receive two sets of standard audio-cassettes, or a set of audio-cassettes and a printed workbook. One set of audio-cassettes would contain the video signal. The other set of cassettes - or a workbook - would provide the verbal instructions and exercises to be carried out. (The student would use his own cassette playback machine for the audio-cassettes with the verbal information.) Assuming a maximum cost of £30 for the control panel, 8 C60 cassettes with video signals, 8 C60 cassettes with verbal information, and a short instruction manual, costs per student would be as follows:



Digital Audio-Vision

Control panel: £30 ÷ 6	£5.00	
Packing and mailing	£3.00	
Instructions manual	£0.50	
16 C60 cassettes @ 33p. each	£5.28	
Total cost per student	£13.78	For 60,000 students: £826,800

We can calculate distribution costs for courses of various sizes as follows:

Table 36. Distribution Costs of Digital Audio-Vision (or TV "Games")

No. of students on a course	100	200	300	500	1000	2000	3000
% of courses in a steady state	1%	14%	16%	31%	34%	←——— 4% ———→	
Cost per hour	£1.72	£1.72	£1.72	£1.72	£1.72	£1.72	£1.72
Average cost per student	£13.78	£13.78	£13.78	£13.78	£13.78	£13.78	£13.78
Total costs - over 6 years - for 8 hours	£8268	£16536	£24804	£41340	£82680	£165360	£248040

These costs are a little expensive, but by no means outrageously so, and indeed we may have been over-cautious in setting a unit cost of £30 each, and the need for 16 cassettes.

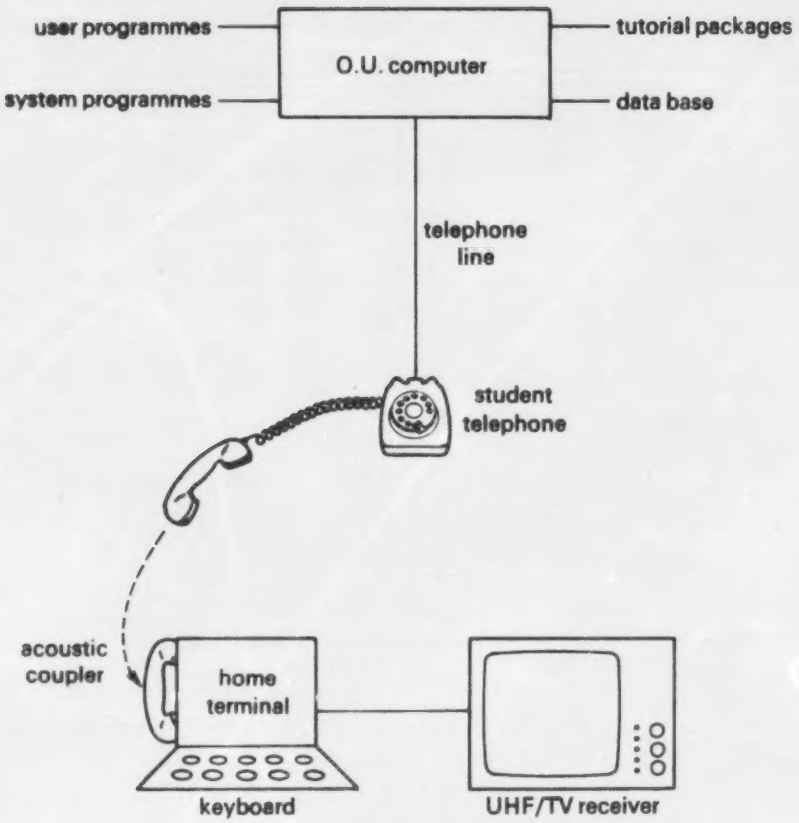
We have arranged a visit for September for interested members from the Technology and Mathematics Faculty, Student Computing Service, and our own research group to visit the GIM factory, to talk to their technologists and programmers, and to see a display of their equipment.

Irrespective of the outcome of such a meeting, we are convinced that we are on the verge of a breakthrough in the use of digital electronics for teaching purposes, and it is absolutely essential that the University continues to monitor very carefully developments in this area.

Domestic Computer Terminals ("Econotype")

The Technology Faculty and Student Computing Service are developing a small home computer terminal which would use a standard domestic television set as a display screen. The domestic computer terminal "Econotype" would be connected to the aerial socket of the television and, using an acoustic coupler, would connect, via the public switched telephone network, to the Open University computer (or any other available computer). To use the domestic terminal the student would dial-up the computer and using a 12-button keypad or alpha-numeric keyboard commence work. Textual information and simple graphics would then be displayed at 30 characters/second on 24 lines with 40 characters to a line. The student could be directed through programmed material, CMA questions, supplementary material, or he could have a dialogue with a course team member or programmer (located in SCS). Thus the facility would be interactive, available whenever required by the student. (see illustration overleaf)

Some of the planned uses for the domestic terminal, tutorial guidance and on-line CMA type question/response guidance, are at present being carried out by the Student Computing Service through its computer-based tutorial system, code-named Cicero. At present students are using the terminals at approximately 160 locations throughout the UK. Thus the skills both at the Walton Hall end and at the student end, for using computer terminals for regular tutorial assistance and programmed lessons, are being developed. 75



Domestic Computer Terminal

The cost of a home-based computer terminal would include the cost of the terminal, the telephone charges and manpower costs for the programming material (academics and computer programmers). The development of the "Econotype" domestic terminal is still at the prototype stage, so as with Electronic Blackboard and Digital audio-vision, actual costs can only be approximate. At the moment a per unit cost on a production run of 150 would be £400, including the alpha-numeric keypad and acoustic coupler. A production run of 2,000 may reduce the unit cost to £200. Telephone charges would, at trunk call rates, average £1 per hour, per terminal. Manpower costs for the academic would be the time he spends at the Walton Hall terminal and his participation in the writing of programs with computer programmers.

Frankly, even given the most optimistic cost predictions, we cannot see the University being willing to provide, even on a small scale, a terminal unit costing £200 for students in their own home. Even if the machine is amortised over six years, the yearly cost per student would be £33.33. To this would need to be added the cost of packaging, mailing and recovery, at around £12. Assuming a terminal use of approximately 8 hours per full-credit, this would add another £8 per student. This would bring the average cost per student nearer to £53.33 per year - or over £3 million if made available to all students. If the University wishes to provide a home-based computer facility, we believe that this would be more economically achieved through the development of Viewdata. However, in fairness to those working on the development of an "Econotype" Domestic Computer Terminal, the University should give some guidance as to the maximum target figure for the unit cost of such equipment. We ourselves would question the wisdom of purchasing any single piece of equipment involving the University either in a total expenditure exceeding £1,000,000 a year, or in excess of £50 per student per year, whichever is the greater, just for the equipment alone.

Other Audio-Visual Distribution Systems considered but not pursued

In our survey of audio-visual systems we began by looking at various other methods (than broadcast TV) for getting equivalent filmed or televisual material to students in their own homes. Three alternative methods were considered: video-cassette, video-disc and super 8. However, we very quickly realised that each of these techniques have considerable hardware and/or software expenses which, when compared with the transmission cost of television (£302 per hour) make broadcast TV a much cheaper distribution system, even when there are courses with only 100 students. Briefly the expenses which would be involved in each of the alternative distribution systems are (for synchronized sound and motion material originally shot on 16mm. or from a TV studio production):

	VCR	Video-disc	Super 8
Cost of playback device	£500	£300	£100
Depreciation + maintenance (over 6 years) per year	£87.50	£54.00	£21.00
Cost of software material	£15 for 30 min.	10p. + for 10 min. (depending on No. of copies)	£3 for 4 min.
Mailing of software	23p. (per cassette) or mailed with kit)	None (mailed with units or kit)	23p. or mailed with kit
Handling (mailing of kits, checking software material, warehousing)	£15 p/a	£15 p/a	£15 p/a

If we were to attempt to distribute via these systems the equivalent amount of material to 16 TV programmes i.e. 16 x 25 min. of animated visual material with synchronized sound, the annual cost per student would be as in Table 37:

Table 37. Average distribution cost per student per year for home-based video or super 8 film systems

	VCR	Video-disc	Super 8
Annual cost of equipment + maintenance	£87.50	£54.00	£21.00
Handling + mailing (sent as HEK)	£15.00	£15.00	£15.00
Software material cost for 16 x 25 MIN. = 400 min. playing time ÷ 6	£26.66	£0.66	£50.00
Total	£128.66	£69.66	£86.00

Thus, in comparison with the TV transmission cost of 16 TV programmes (transmitted twice) to say, 200 students, which would cost £24.16 per student per year, use the existing equipment of students (their home TV set), and not involve any software material distribution (since it is broadcast), the cost of the alternative systems would seem a pretty poor bet. Of course, if the student did have the opportunity to control the playback and had the opportunity to stop, move forward and replay, the material then almost certainly would be designed differently than if it was for broadcast transmission. In such a case, it would almost certainly not be necessary to use the equivalent amount of playing time. Nevertheless we believe that given the relatively low-cost of television transmission, if there is essential motion with synchronized sound, then broadcast television would be the most cost-effective system to use even when there are low student numbers.

SUMMARY OF DISTRIBUTION COSTS AND CONCLUSIONS REGARDING DIFFERENT AUDIO-VISUAL MEDIA

To enable the University to have some overall grasp of the comparative costs of distributing various audio-visual media to students, we shall draw up a summary table. (Table 38). However, we are very anxious about the possible mis-use of this table. The assumptions on which the data for each item have been based are crucial. Furthermore, this table takes no account of the comparative value of each audio-visual medium. There are good reasons why economists are described as knowing the price of everything and the value of nothing, and it is vital that these costs are considered in conjunction with the unique educational features of each audio-visual system, and that these systems are not necessarily seen as replacements for each other. Lastly, the amount of media material provided varies considerably from course to course, and some of the costs fail to reflect this. On the other hand, it is not possible always to give a meaningful cost per hour of material. For instance, where print forms a major part of audio-vision component, it may cover television and radio as well as discs (e.g. DT201).

Thus we strongly recommend readers to use this table not in isolation, but in conjunction with the individual accounts of the costings and educational features of each medium, and costs should be seen as reflecting an order of magnitude rather than precise estimates.

Table 38. Comparative Distribution Costs of Audio-Visual Media (at 1976 figures)

	Average cost per student per year	Total annual cost if available to 60,000 students
Radio transmission	£1.50	£89,856
Television transmission	£6.85	£410,720
Audio-vision: 9 LP records + musical score	£5.86	£351,600
13 Flexi-discs + 4 A/V Handbooks	£4.27	£256,200
12 Cassettes + 2 Media Booklets	£5.27	£316,200
16 (additional) radio + 4 Media Handbooks	£7.53	£334,000
6 Cassettes + 4 Media Handbooks	£6.59	£395,400
4 Media Handbooks (excluding radio costs)	£4.07	£244,200
3 Cassettes + 180 x 35mm. slides	£16.66	£1,000,000
3 Cassettes + low-cost viewer/film-strip	£3.86	£231,600
3 Cassettes + high cost viewer/film-strip	£8.36	£502,800
Mixed-mode super-8mm. Cassette system	£56	£3,360,000
Telephone teaching: all with access - 8 hours	£18.24	£963,000
" " : 50% access - 8 hours	£18.24	£547,200
" " : 33% " - " "	£18.24	£364,800
Digital Audio-Vision: 16 C60 cassettes + control panel	£13.78	£826,800
Video-cassette machines (home use) 16 cassettes + machine	£128.66	£7,719,600
Video discs (home use) 40 discs + machine	£69.66	£4,179,600
Super-8mm. 16 cassettes + machine	£86.00	£5,160,000
Domestic Econotype Computer Terminal - 8 hours	£53.33	£3,199,800

As a result of these costings, and the studies of the individual audio-visual media we have examined, what recommendations could we make to the University regarding the kind of media that should be used in course design in the next few years?

First of all, we believe that the commonly held view in educational technology that education makes use of and adapts commercially developed media systems, rather than invents its own, is still valid for future developments at the Open University. Since the developments of most value will be for courses with low student numbers, the University will require equipment which has been developed for other uses for a mass-market, but which can be easily and cheaply adapted for Open University purposes. Even for our largest courses, the scale of manufacture for a new piece of electronic equipment will usually not be great enough to reduce costs to a sufficiently low level for issue to students. The most viable systems will be those that will already be in every student's home, or which students can buy themselves at low-cost and use for other domestic purposes (such as audio-cassette machines). We do not believe that the extension of development work for home experiments to the design and manufacture of anything but the simplest electronic equipment is economically viable, without major investment, combined with a radical reorganisation of the University's research and development policy (an issue we discuss in more detail later in p.65).

For these reasons, we think the most promising developments for the University are Viewdata and digital audio-vision, especially if television games technology can be adapted. If Electronic Blackboard is taken up by a major manufacturer, then this might also be an important development, although its economic viability would still be somewhat doubtful.

Unfortunately, the time-scale for such developments is tantalising. It is possible that within three years we could have a number of courses making use of digital audio-vision, if TV games technology can be sufficiently and economically adapted. It is also possible that within five to 10 years, we could have a number of courses making use of Viewdata, although the University has to rely on the ability of the Post Office to persuade television set manufacturers and the general public of the value of Viewdata, before we can expect the majority of students to have the appropriate sets. Telephone teaching is already in use in the University, but we see this more as an alternative to face-to-face tuition than an alternative to audio-visual teaching.

So what can we recommend for courses being designed in the next two or three years, and being first presented when the transmission problem will be nearing its most critical state? We believe that there is a solution which is flexible enough to meet a wide variety of educational needs on a wide variety of courses, a solution which is already being used to some extent in the University, and which is not prohibitively expensive. That solution is audio-vision. This may not be so glamorous or exciting as the new electronic developments, but it has very strong educational advantages and can be used almost immediately, without requiring a major investment.

At the same time, we do not wish to underestimate the importance of developments in electronics. During this study, we have been continually coming across new developments of potential value to the Open University's teaching system.

Consequently, with regard to the problems the University faces regarding a shortage of transmission time, we would make three major recommendations:

1. Because there is no immediately available alternative to television, we recommend that the provision of a video-replay service for study centres must be the first priority, to ensure that existing media, in which there has already been a massive investment, can be fully used by students.

2. New or remake course teams should be encouraged to use simple, low-cost, audio-vision (sound, plus print, or possibly film-strips) for two purposes:

   (a) to reduce the demand for radio transmission time particularly, (and possibly television to a lesser extent on some courses) by using cassettes, and print, for courses with low student numbers, instead of radio,

   (b) to reinforce the role of radio - which has by and large been much underused in the past by students - for courses with high student numbers.

3. The University needs to monitor more carefully and thoroughly than at present developments in electronic media, as these will have vital implications for course design at the Open University.

We would also like to raise a number of issues for discussion.

1. We think that one priority for research and development in electronic media by Open University Academic Staff should be in the development of digital audio-vision, using or adapting existing low-cost processing hardware - such as TV games technology - rather than developing original processing hardware. Other efforts should concentrate on simplifying the method of preparing graphics, and on exploring the most appropriate educational uses, for digital audio-vision.

2. Programming and systems being designed for use in the students' home, and using the domestic television set as a visual display unit should try to ensure that programming and the visual display system is compatible with and exploits fully the Viewdata equipment.

3. A joint research project with the Post Office should be mounted to use Viewdata facilities in the design of a course being presented for the first time in 1980.

4. Planning Board might like to consider whether guidance should be given to Open University staff engaged in research into useful equipment for Open University teaching, regarding the likely maximum unit cost that Planning Board would be prepared to consider for a single item of equipment to be distributed to students. A unit cost of £100, even amortised over six years, with packaging, mailing and recovery charges, would involve the University in an annual expenditure - regardless of depreciation - of approximately £1.5 million, if the equipment was to be made available to all students. To this would then need to be added the costs of distributing programmes, and production costs involved in preparing materials. We would argue then that domestic computer terminals, video-disc machines, mixed-mode super-8mm. cassette systems, Electronic Blackboard, etc., must aim at a unit cost of well below £100, if they are to be viable for Open University teaching purposes.

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POLICY, ORGANISATION AND RESPONSIBILITIES

Innovation at the Open University

Some commentators have noted that virtually all the major innovation associated with the Open University have stemmed from its very early days. This is certainly true regarding audio-visual media. With the possible exception of audio-vision and telephone teaching, both of which are hardly radical and still constitute only a very minor part of the teaching system, there has been virtually no innovation in the use of audio-visual media. Why is this? Some reasons are obvious. The priority in the early days was to make the University work, to learn how to integrate television and radio with our other media. Until the last year or so, television and radio have been comparatively abundant resources. With the exception of satellites and video cassettes, the early 1970's saw little in the way of communications development, certainly little that had practical relevance to the Open University.

But things are changing. We know better now the potential and limitations of television and radio. Furthermore they are becoming an increasingly scarce resource. There has been a fundamental shift in the balance of the University, from providing a small number of courses for a large number of students, to providing a large number of courses for small numbers of students. This is having a fundamental effect on all aspects of the University, but most of all on its media requirements. And, as we hope we have shown, there are several communications developments coming through which hold out considerable promise for the Open University's teaching system and which offer some partial solutions to the problem of providing home based audio visual materials to a comparatively few students, scattered all over the British Isles.

These developments seem to us to raise some fundamental questions for the University. First of all, how important is it that the University remains in the forefront of developments in distance teaching? To what extent does it wish to remain a leader in the use of audio-visual technology in education? Or is its use of media now more or less "right", requiring only minor modification or adjustments to deal with changing circumstances? Are the possibilities offered by new developments in communications at best a distraction from the real purpose of the University and at worst a chimera, a total waste of time and energy?

One of the aims of this study, therefore, is to bring this issue into the open as a topic for University discussion. Should the University be giving a greater priority to developing and applying new communications developments to distance teaching? And if so, is it equipped to do so?

On the policy issue, we do believe, not surprisingly, that the University should give a greater priority to applying new media. There might be a case for an institution such as the Open University <u>always</u> attempting to be in the forefront of such innovation, taking calculated risks, developing new technology and methods, not just for the University itself, but for the many institutions and systems which look to the Open University as an example and an inspiration. However, we would argue that there are more self-interested reasons for innovation. The University, as it approaches its "steady" state, is changing

sufficiently enough for it to be absolutely necessary to give greater priority to developing and applying new technology to its teaching system, if it is to continue to meet the needs of its students. If open education is to mean a substantial number of courses with student populations of less than 200 students, then audio visual media can be provided in students' homes at reasonable cost only by means of major advances in current communications technology.

The question then arises as to whether the University is able to innovate, to adopt or adapt new technology for its purposes. We have serious doubts about this also, given its present structure. There is more money available in the Open University for research into the volcanoes of Peru or the social life of the modern French Peasant than there is for research into telephone teaching or to design an electronic blackboard device. Even when research into a new communication technology is carried out thoroughly and competently, a need identified, and the innovation properly costed, the decision-making machinery cannot adequately cope with the proposals, as those associated with the history of the video-cassette scheme will recognise.

In this final part of the study then we look at the problem of introducing alternative media to the Open University and then managing them.

Supporting Innovation

The University does not actively support innovation in educational media. Indeed, wittingly or not in practice it discourages it. We believe there needs to be changes in three areas, if the introduction of appropriate new media is to be carried out successfully. These are finance and accounting, organisational structure, and course design.

Funds

We were most encouraged to find in the University small groups of people who were committing their time and energies to finding or adapting communications technology to the changing needs of the University. They all had one thing in common - lack of support and resources from the University. Each of these projects had at most funds for a research assistant, and some bits of equipment, on a very modest scale.

Money for the development and implementation of a new technology is needed at a number of stages. First of all for a new piece of equipment money is required for research - getting a prototype machine to work reliably. Money is required for research and technical staff, and also for equipment.

There are two major areas of funding for research in the University. By far the largest is the Research Committee, with funds of over £300,000 in 1977. The second is the Institutional Research and Development Committee with funds of £30,000 in 1977. Those wishing for funds to research and develop equipment which might be relevant to Open University teaching are virtually debarred from applying to the Research Committee for funds. They will be referred to IR and DC. Frankly, we cannot see why someone who wishes to carry out initial research into the development of a prototype machine should be debarred from Research Committee funds merely because it might at some stage find its way into the Open University

system. We believe that there is a fundamental difference between research into equipment, which may be relevant to Open University teaching, and institutional research, i.e. research into the Open University teaching system. It would only be when the effect of the equipment on the Open University teaching system comes to be evaluated in the context of an actual course that we foresee some boundary problems between Research Committee and IR and DC. Therefore we recommend that research into equipment should not be automatically debarred from Research Committee funds. However, it is not the research stage which appears to be the main problem. In general, Open University academic staff have been able to obtain small sums of money, if with some difficulty, for this kind of equipment research.

It is at the second stage where the main problem arises. This stage is development - getting enough money to produce enough machines to pilot on a course, to establish the feasibility of the equipment itself and its usefulness as a teaching device. With new equipment this means finding a manufacturer willing to take on the production of small quantities. Probably at this stage also, there will need to be a design input to provide economical assembly, a suitable casing and easy user operation. Because of the risk element - there is no certainty at this stage that any subsequent orders will follow - it is probable that the University would have to pay for these developments. But the sum involved - just for one pilot course - are very substantial. A prototype model of Electronic Blackboard would cost about £300 a model for a run of 100, or a total of £30,000. This would clean out the IR and DC fund, especially if it had to find additional money to evaluate the application to a course. But where then should the development funds come from? One might say the manufacturers, but why should they risk their capital without any commitment from the University to buy large quantities? There are only two committees in the University with anywhere near the resources to fund such a project: Research Committee and Planning Board. This would not seem however appropriate for Research Committee funding, and in any case, as with Planning Board, would they be able to evaluate thoroughly the technical feasibility, the likely pedagogic use, and the likely costs of implementing the system on a large scale, if the pilot was successful? The Research Councils may be interested, but again it would probably need broad-based University backing, and commitment to pilot the equipment, before a Research Council would commit money on such a large scale.

Finally, there is a more controversial problem. What are the chances of a small team of academics, working in isolation, being able to develop a prototype likely to be commercially successful, in the face of competition from some of the largest companies in the world? To be frank, Electronic Blackboard has already been invented - so too has digital audio-vision. The problems the University faces in this area are exactly the ones being faced by the commercial organisations which hold copyright or similar products: would enough people buy the machine to make it a viable proposition?

It would seem to us that the University must make a choice. If it wishes to go into the business of designing distance teaching equipment, it needs to do this on a more professional, commercial basis. It is not the technology which is holding back Electronic Blackboard, Digital Audio-Vision and Domestic Computer Terminals. We have the technologists who can do this. So, we suspect, do the commercial companies. It is the question of the financial viability of such inventions. Thus either the University must build up a research "business", with marketing expertise, capital investment, and a willingness to take large financial risks, or it should advise its academics to avoid duplicating research being carried out elsewhere. An alternative would be for the University to approach a commercial company in this field, in the form of a partnership, providing a test-bed for equipment in return for research

support and investment. What does seem to us to be undesirable is for academics to spend their research time trying to develop equipment of potential value to the University's teaching system, but which stands very little chance of being funded beyond the prototype stage, because the University itself cannot - nor should not - take the financial risk.

The third stage where funding is required is for piloting and evaluation (whether new or existing equipment). The equipment needs to be tried out on a low population course, to evaluate its attractiveness to students, its ease of use and reliability, how much it helped them in their understanding, etc.

The final stage is dissemination of the information to course teams, the decision of the University on whether or not to assist the system and if so, the placing of orders where appropriate.

Those who have been concerned with the in-house design and development of machines have found it difficult to get any money at all at most of these stages. We believe that this is due partly to the University's current priorities and partly due to the organisational structure.

Structure

We have already drawn attention to the lack of an appropriate committee or group within the University to evaluate the technical feasibility, the possible pedagogic value, and the likely costs of developing and implementing a piece of equipment for the University's teaching system.

We would also point to the difficulty that will arise in trying to implement our earlier recommendation that greater use should be made of audio-vision to ease the radio, and possibly television, transmission problem. Radio and television resources are allocated by Broadcast Sub-Committee. Audio-vision resources are allocated by Course Resources Committee. What happens however if radio production resources (allocated by Broadcast Sub-Committee and managed by the BBC) have to be switched to meet an increase in demand for audio-vision production resources? Perhaps more fundamentally, what inducement is there for course teams to go for audio-vision rather than for broadcast resources, when these are, at the moment, treated as separate resources? Why not go for both? We do not think that either of these problems is insuperable, but we do draw them to the attention of Course Resources Committee and Broadcast Sub-Committee.

There is also the problem of the diffusion of innovation. At the moment each of the various media we have examined has a "champion": Chris Pinches for Electronic Blackboard, Peter Zorkoczy for Viewdata, Graham Read for digital cassette vision, Graham Jones for home computer terminals, Ben Turok for telephone teaching, Tony Bates and Margaret Gallagher for an audio and video library system, Larry Kern for audio-cassettes, and BBC producers for television and radio. These champions are vital for exploring the potential of each medium, and for bringing to the University's attention the possible benefits. On the other hand, as all the "champions" we have talked to recognise, personal advocacy of a single piece of equipment or medium is the antithesis of an integrated systems approach to distance teaching. Because, however, there is no clear structure or forum for examining professionally the technical, educational and cost benefits and limitations of each medium, individuals are left to struggle on their own to persuade, cajole or browbeat the "system" to take up, or support,

their medium, with the inevitable frustration and haphazard development. We wish to support fully the idea of champions for individual media. We also though want to see a framework which will be more supportive of their effort. We know that those we have spoken to would strongly support such a framework, even if it were to lead to the eventual rejection of their proposals. At the moment our "innovators" feel they are working in the dark.

A related problem arose with the video-cassette project. Although the piloting was funded by IR and DC, it was necessary to set up an ad hoc advisory group which reported directly to Planning Board. This particular project has had a long and troubled history, mainly stemming from the magnitude of the sum required to provide a national system. £200,000 is just too large a sum to be found out of recurrent expenditure. We can understand the difficulty and resistance of Planning Board in accepting the funding aspects of the VCR scheme. The continual referring back, however, by Planning Board and other bodies on technical issues - such as the choice of equipment or the feasibility of other equipment such as video-discs - is less easy to understand, especially since these matters had all been carefully considered. This attitude can only be attributed, in our view, to the lack of a properly constituted group seen by Planning Board to be competent in deciding these issues.

We are inexorably drawn, therefore, to the conclusion that there should be a Media Development Group or Committee within the University, responsible for promoting media developments, sifting, giving priority to, and endorsing proposals for media research and development funds, and monitoring expenditure on different audio-visual media. We do not see this Group as having its own funds, but as a "sifting" agency, advising Planning Board, Research Committee, IR and DC, Course Resources Committee, Broadcast Sub-Committee and Academic Board. It should cover the whole of technical developments in communication systems, including print developments and computer-aided instruction. It would report to Planning Board. Its membership should reflect the five main interests: technical, educational, cost, operations and regions. Because it would not be directly responsible for allocation of resources, its membership should be drawn mainly on a professional rather than on a University wide representative basis. We wish to stress this professional aspect, because it has implications for the way the group would work. It should base its recommendations and decisions on the result of detailed enquiry, rather than on just the opinions of those gathered around. We foresee members of the group, or experts outside the group, being commissioned to look at a particular aspect of communications technology, and reporting back to the group. Membership of the group then should be guaranteed for representatives of certain areas of professional interest. The details of such a group could be argued about, but some of the following should be represented: Operations, Publishing, Media, Bursary, RTS, BBC, Student Computing Service, Telecommunications Research Group, Audio-Visual Media Research Group, Textual Communications Research Group and a Technology Faculty representative. Because of the need for a strong evaluation and innovation policy, we recommend that the Chairman should be a member of Planning Board, and preferably an academic.

Since compiling this report, we have learned of the proposal of the Dean of Technology to reconstitute the Telecommunications Research Group, with broader terms of reference, to cover all areas of communications technology. We believe that these two proposals are virtually identical, and since both were arrived at independently, this supports the view that there is a need for the creation of a new group. We hope that if the development of a new communications technology group is going ahead, it will take into account the points we have just made regarding its role and membership. (We have retained our name "Media Development Group", since we are not sure what the new group proposed by Professor Sparkes will be called.) 86

It is with great reluctance that we are proposing yet another committee or group within the Open University. However, we recommend that the Media Development Group should take over some of the functions of the Production Methods Committee. Part of the Production Methods Committee's third term of reference is:

> " ... to provide the investigation of new or alternative methods and systems, to act in co-ordination with the (IR and DC) in all proposals for investigations ... "

This it has clearly not done - nor was it reasonable to expect it to do so. The Production Methods Committee is composed largely of those responsible for the day-to-day management of the Open University system. There are enough problems in that area to keep it fully occupied without looking five years into the future. In any case, it does not have the technical nor pedagogic expertise to examine such possible future developments, and yet many of its problems result from a University-wide failure to antitipate the consequences of its academic policy. We therefore suggest that there is a need for both the Production Methods Committee and a new Media Development Group.

One of the major tasks of a Media Development Group would be to encourage course teams with low student numbers to pilot new media developments, on a course as a whole, at summer schools, or in study centres.

When piloting these new media, we believe that the integration of the new media with other media is essential. Thus the combination of Electronic Blackboard with radio (for students who are not on the telephone) or the combination of Viewdata with computer-aided instruction, such as SCS's CICERO system, would be worth trying. Thorough educational evaluation will need to be mounted on these pilot courses, and we hope that IR and DC will give priority to such projects in the early 1980's. Research will also be needed to install the necessary equipment and write the appropriate software (or train course team members to do the work themselves). The setting up of a Media Development Group is therefore important for assisting and co-ordinating these developments.

We hope, therefore, that appropriate course teams will be stimulated by this report to volunteer for piloting of new media.

Student Costs

One aspect of the development of communications technology which we hope will be closely watched by the Student Affairs and Awards Board is the likely impact of the new media on student costs. Already the Science Foundation Course remake is assuming that students will have access to a colour television monitor and an audio-cassette player. Additional financial demands on students are being made continually by course teams. Particularly with regard to information transmitted by means of the telephone (e.g. Viewdata and telephone teaching), students could easily be disadvantaged if they were expected to carry some of the charges.

Location of Production

Of all the issues we have examined this is the most difficult. Who should be responsible for the production of non-broadcast audio-visual media?

At the moment, the BBC produces non-broadcast audio materials, if requested by a course team, and if the producers associated with the course teams can carry the additional workload. Since in general demand so far for non-broadcast audio material has been small, this has not led to any demand for extra production resources. Furthermore, there seems to be no objection in principle from the BBC management to the BBC producing non-broadcast audio material, provided that the material is related to a course with a broadcasting component. Indeed, the BBC Open University Production Department would like the BBC to be responsible for the production of all audio material, whether broadcast or not.

However, the issue is not quite so straightforward. We do not wish ourselves to make recommendations in this area, since we believe that this is an area for joint negotiation between the BBC and the OU at a senior management level. We merely wish to indicate some of the problems as we see them.

As already mentioned, we foresee no significant increase in costs whilst non-broadcast audio production replaces radio production and takes up underused ratio production capacity. Should, however - as is possible, the demand for radio and non-broadcast audio material reach a level where existing BBC production facilities - either staff or resources - cannot cope we believe that the additional audio production required should be undertaken by the Audio-Visual Services Unit at Walton Hall (until the new Studio Centre is available).

Secondly, non-broadcast audio and radio-vision materials require a different style of production from radio on its own. We have already enumerated the educational differences between the two media (pp.29 - 32). Producers who are to be involved in the production of non-broadcast audio materials, or radio-vision, will need a short period of training, if the educational potential of cassettes and radio-vision is to be fully exploited. It was quite clear from Berrigan and Gibson's study that a number of basic mistakes were being made in the production of audio-vision programmes. The pace was often wrong, the materials to be read or seen were difficult to locate, etc. There needs to be more discussion also in the University and BBC about the relative roles of radio and cassettes, when both are being used in the same course.

A third aspect is that it is possible for academics to produce their own cassette material without a producer being involved. There are though several dangers in this. Perhaps of most importance is the likelihood of errors of fact, mistakes, bias and poor presentation - in other words, a loss of quality control. Another danger is that of duplication with the role of other media, such as radio. In general, every cassette production ought to be "produced" to some extent, to maintain as far as possible high technical and presentation standards.

Nevertheless, the producer's role in the production of audio-vision is bound to be different from his role in straight radio. The academic can integrate the cassette and visual material as he designs the unit, relating each part of the tape to the visual material. The producer, even if involved in discussions from the start, will normally be handed a more finished product for audio production than would be the case with a radio script. Some academics, particularly in the Mathematics Faculty, are now highly skilled in the design of audio-vision materials, although even here, BBC producers have generally produced the final tape. Also, particularly where radio-vision is being used, it is important to "trial" or pilot the pace of the programme and the clarity of instructions on "naive" subjects, before transmission or distribution.

Then there is the question of who should produce the visual material. We have seen in fact that the printed component can be substantial, and because of this, we would generally expect this to be done as part of the University's general publishing and media operations.

We have discussed mainly the questions which arise from the location of production of non-broadcast audio media, such as cassettes and discs. We would also draw attention to the production aspects of some of the newer technologies, such as digital cassette vision, Viewdata, and Electronic Blackboard. These require some skill in preparing computer graphics and simple but clear visual displays. We are not sure whether these skills can be developed by the academics themselves when they prepare material for such systems, or whether specialised design skills will be required.

In this section, we have only touched on what is a very delicate issue. We have not mentioned some of the real difficulties and indeed bad feeling that has occasionally been generated at a working level between BBC and OU staff over the questions of location of production. Because we foresee a rapid expansion in non-broadcast audio materials and audio-vision, and because of the new problems being created by the introduction of new media, we make only two recommendations (both of which in fact are already being implemented):

1. That the Joint BBC/OU Management Committee discuss the <u>principles</u> of the production of non-broadcast audio material as a matter of urgency.

2. That an informal BBC/OU working group should be set up to examine in detail the implications of non-broadcast audio materials and radio-vision for styles of production.

We do not believe that there are any insurmountable problems in this area that cannot be worked out, given good will on both sides. What we do believe however is that it is dangerous to assume that there <u>are</u> no problems in this area.

<u>Implications for the Studio Centre</u>

It would seem, given likely future developments, that it would make sense to ensure that space is available within the new Studio Centre for a small amount of equipment, such as a computer or Viewdata terminal, graphic generating equipment for digital cassette vision, etc., within a sound production area, so that audio and non-broadcast video signals can be produced together.

Conclusions and Recommendations

We have argued that the University will need to look to new developments in technology to meet the needs of its students as it nears the steady state. We have also expressed doubts as to the University's current capacity to adapt to these new conditions and in particular to innovate. We have therefore made a number of suggestions to support the possibility of innovation, which should be discussed within the University.

1. Research Committee funds should not be debarred from those wishing to research and develop equipment which might be relevant to Open University teaching.

2. If the University wishes to design and develop distance teaching equipment, it ought to consider whether the University should build up a research "business", with marketing expertise, and capital investment, either on its own, or in partnership with a commercial company. It should also consider whether the Research Committee or Planning Board should advise academics that the University will not generally fund new inventions beyond the prototype stage.

3. Broadcast Sub-Committee and Course Resources Committee need to discuss how course teams with low student numbers can be encouraged to reduce their bids for broadcasting and to increase their bids for non-broadcast audio-vision resources.

4. The University should set up a Media Development Group, responsible for promoting media developments, sifting, giving priority to and endorsing proposals for media research and development funds, monitoring expenditure on different audio-visual media; and encouraging course teams to pilot new media developments.

5. The Joint BBC/OU Management Committee should urgently discuss the location of production of non-broadcast audio materials as a matter of urgency.

6. An informal BBC/OU working group should be set up to discuss the production implications of non-broadcast audio and radio-vision materials.

7. Space in the new Studio Centre should be available for a small amount of non-broadcast video generating equipment, to be used in conjunction with sound production.

Appendix 1. Steering Group for the Study of Costed Alternatives to Open Circuit Transmission

Members

Prof. R. Stannard, Chairman.

Mr. M. Watkinson, Secretary.

Mr. P. Girling, Mr. A. Watkins } Operations.

Mr. B. Hollis, Bursary.

Mr. N. Freethy, OUEE.

Ms. G. James, RTS.

Mr. T. Robertson, Correspondence Services.

Prof. J. Sparkes, Technology.

Dr. A.W. Bates, Mr. L. Kern } Audio-Visual Media Research Group, IET.

Dr. J. Stevenson, Mr. D. Holms, Mr. D. Thorogood } BBC.

Appendix 2: List of Persons and Organizations to Contact with regard to the Various Audio-Visual Technologies described in the Main Report.

1. Non-Broadcast Audio-Vision and Radio-Vision presently being used on Open Universuty Courses.

Frances Berrigan,	I.E.T.
Anne Gibson,	I.E.T.

2. Viewdata

Peter Zorkoczy,	Technology Faculty
Mr.W.J. Bray,	Post Office Research Centre Martlesham Heath.

3. Electronic Blackboard

Chris Pinches,	Technology Faculty
David Liddell,	" " " "

4. Digital Audio-Vision

Graham Read,	Mathematics Faculty
Paul Bacsich	" " " "

5. Electronic Television Games

David Letheren,	General Instruments Microelectronics Ltd., 57/61 Mortimer Street, London, W1N 7TD.

6. Telephone Teaching

Ben Turok	Senior Counsellor, Open University, London Regional Office.
Sandy Hammond	London University.

7. "Econotype" Domestic Computer Terminal

Graham Jones	Technology Faculty

8. Video-Disc

Mr.A.Griffiths	Decca Records London,

9. Super 8 Projector with Synchronized Audio-Cassette

Mr.B Blakemore	Colour Cassettes Ltd. London.
Dr.P.R.Adby	Dept.of Electrical Engineering King's College, London.

10. Combination Slide/Filmstrip Projector, Projection Microscope and Microfiche Reader.

Michael Herten	T.H.D. Manufacturing Ltd., Peacehaven, Sussex.

11. Filmstrip Projector

Mr.K. Littlechild	ESL Bristol Ltd., Waverley Road, Bristol BS17 5RB.

12. Low-Cost Plastic filmstrip Viewers

Mr.S. Fry	Master Ltd., 102 Gleneldon Road, London, S.W.16

13. Filmstrip and Tape/Slide Materials

Mr.Derek Riley	Focal Point Filmstrips Ltd., 35, Cavendish Drive, Waterlooville, Hants.
Mr.B.Hobson	Lanchester Polytechnic Coventry
Mrs.Monica Seeley	Queen Elizabeth College, Chemistry Department, University of London.
Pat Hills Peter Groves	The Chemistry Society Blackhorse Road, Letchworth, Herts.
Dr.R.C.Chivers	Dept.of Physics, University of Surrey.
Dr.John Graves	Medical Recording Service Foundation, P.O.Box.99, Chelmsford.
Mrs.P.Fara	Prismatron Productions 34, Cricklewood Broadway, London, NW2 3ET.